FOUNDRY TRADE JOURNAL

EST. 1902

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ICTR/553/X219

Union Carbide introduce a new shape briquette at new low prices

TV *These new briquettes will be discussed in an Industrial Magazine programme on Television (Midlands and North) at 5.30 p.m. on Saturday 25th February.*

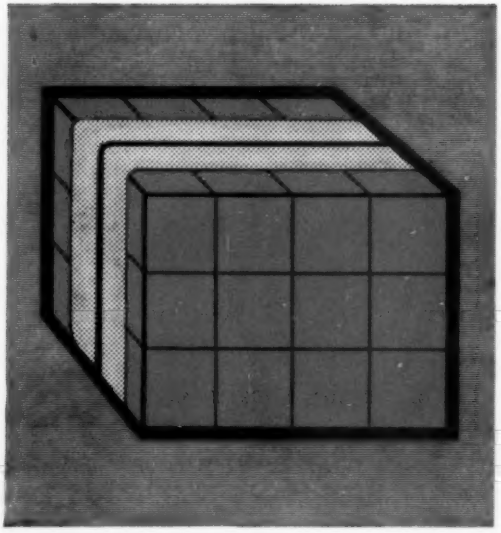
New method of packing

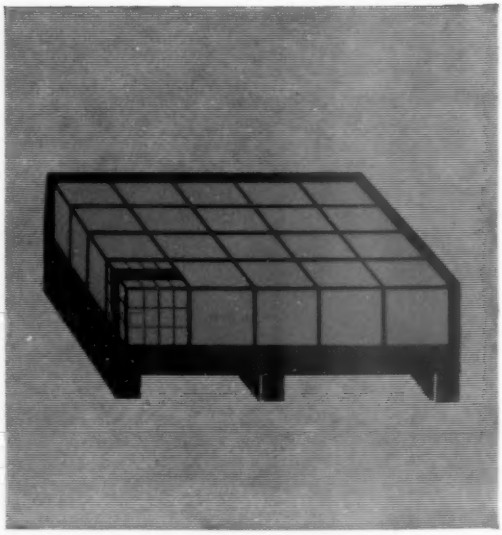
The new briquettes will be packed in easily man-handled bundles of convenient weight (approximately 56 lb) securely fastened with metal straps which can be easily released with a file tang. Quantities over 5 cwt will be supplied on non-returnable pallets.

New square-sided pack easily handled and stacked

These new bundles make for easier handling and stacking—and also simplify mustering for stock-taking.

UNION CARBIDE

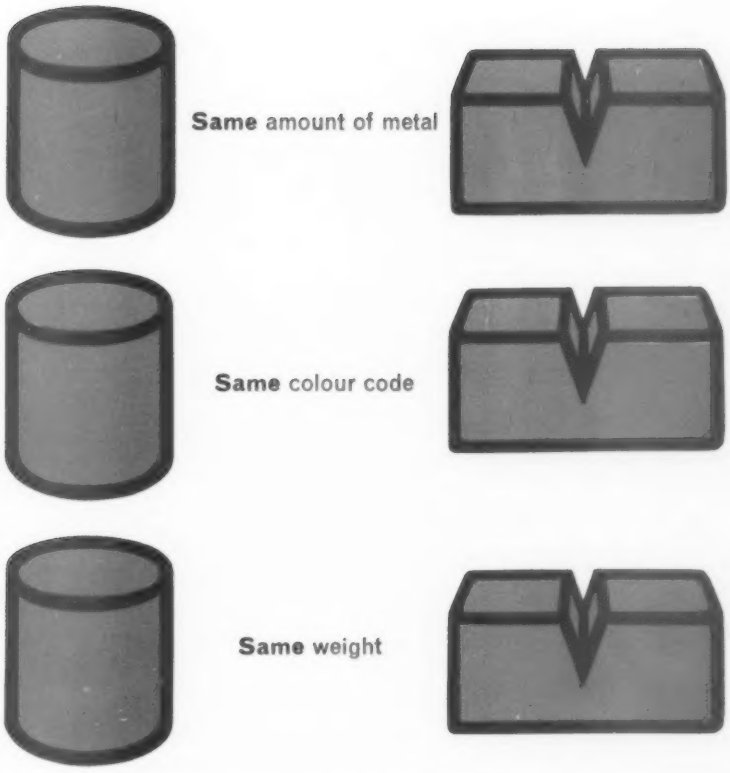




Reduced prices

The new shape and method of packing means reduced production costs—*and these savings are passed on to you.* Tonnage customers do even better!

Standard cupola practice



Means **Same** Melting Practice

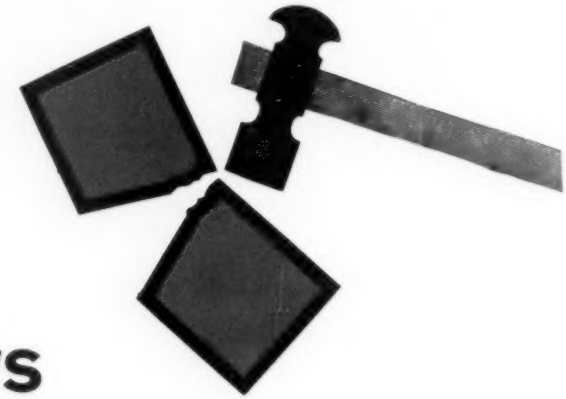
CBC UCA47

Quality control

A remarkable feature of the new briquette is its consistent quality—the result of careful quality control from the raw material stage right through the manufacturing process.

Easily and accurately split into 1 lb halves

Quality Control means that each easily-separated 1 lb half contains the same amount of additive.



All the alloys

The following Union Carbide ferro alloys are available in the new shape:

CHROMIUM
MANGANESE
SILICO MANGANESE
SILICON*
ZIRCONIUM SILICON

Let us know if you want samples of any or all of them.

*In view of the overwhelming preference for 45-50% Silicon briquettes in the past 10-15 years, production will be standardised on this type at a particularly attractive price.

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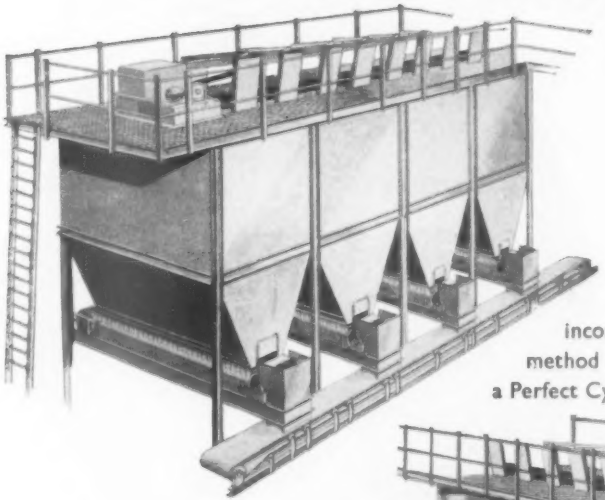
CRC UCA47

FOUMEC

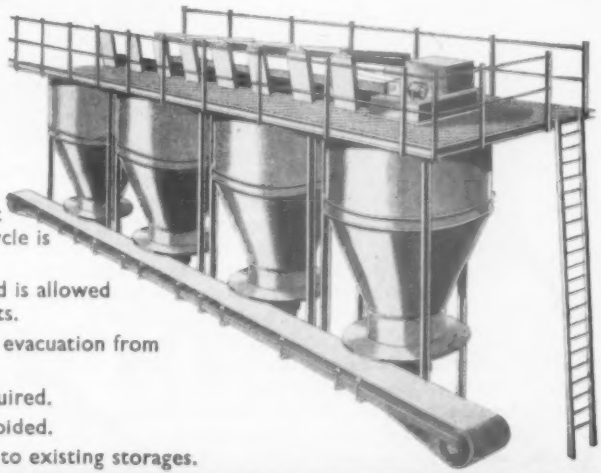
AT LONG LAST!...YES!

SAND STORAGE

AT ITS BEST



The Mechanised Plants we supply incorporate the ONLY 100 per cent. efficient method of ensuring the use of Returned Sand in a Perfect Cycle.



- No 'Piping' or 'Bridging' inside Hoppers.
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F.M.I.

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AP 23

DUST...

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WHY?

For a very sound reason. They are not committed to any particular *method* of dust collection but are concerned with one thing only—the best way to trap a particular type of particle. It might be done with cyclones or multi-cyclones, cloth filters, wet collectors or reverse-jet filters —or a combination of these. Filter-Heat make them all. But for cupola emission they would install their water screen grit and spark arrester, similar to the one illustrated which is shown complete with its specially designed settling tank. They have also considerable experience in the design of hoods for the control and collection of industrial fumes, dust and grit. If you have a dust or grit problem ring them up—at Rugeley 138; Leigh, Lancs 94, or (London) Abbey 3085. The name is . . .

The Filter-Heat water screen grit and spark arrester was operating when the photograph was taken. As you can see against the background of blue sky only steam is escaping.

FILTER-HEAT LTD

(a subsidiary of Sutcliffe, Speakman & Co. Ltd.)

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. . . . . bashing the sides of storage hoppers with sledge hammers to clear sticking material . . . . . low frequency, uncontrolled vibration. Try the modern way. *Correct* frequency, *correct* amplitude vibration applied at the *correct* point . . . . . the SINEX way.

Almost any material is discharged easily. We have plenty of experience. We have dealt with a wide variety of materials and a wide range of hopper designs. We can solve your problem. The illustrations show three typical installations utilising a rotary electric vibrator as a power unit. Our recommendations are based upon consideration of such technical factors as bulk density, granulometry and adhesion of the material relative to hopper design and discharge arrangement.

That's where experience scores! Use SINEX experience on your problem!

✱ *SEND FOR DETAILS* **NOW**

How experienced? We have overcome bunker discharge problems associated with . . . . .

FOUNDRY SAND
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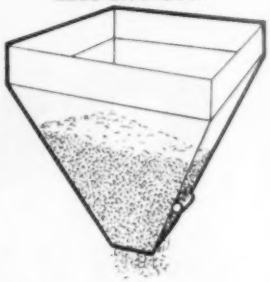
LIME
SODA ASH
SAND . . . . .

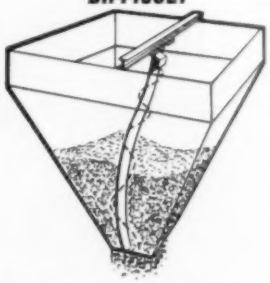
. . . . . and many other materials.

LESS-DIFFICULT



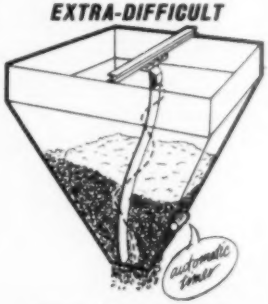
External vibrator on steel hopper.

DIFFICULT



Vibrating reed. Used where external vibration is impractical, i.e. concrete hoppers and difficult structures.

EXTRA-DIFFICULT



Combined internal and external vibration. With external vibrator timed for "on and off" the frequency, when slowing, passes through bunker's natural resonance. Effective regardless of content material.

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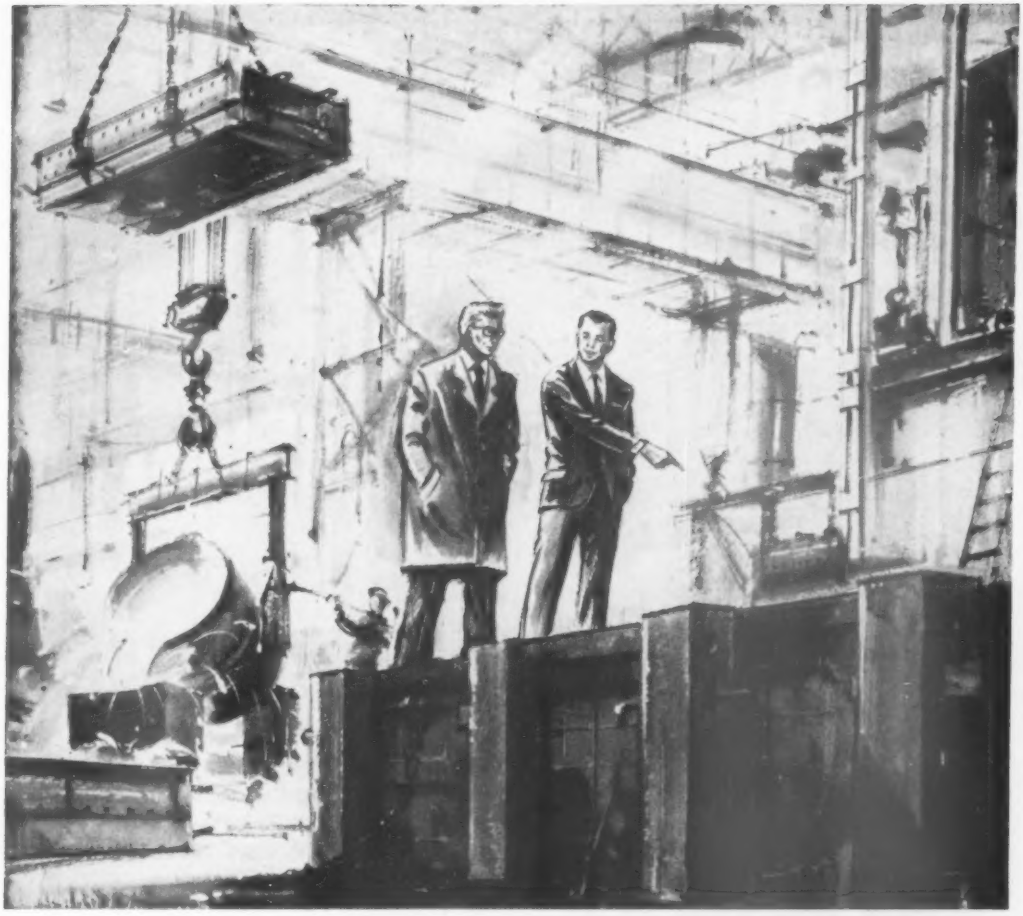

Why should this man tour your foundry with you?

He's the man from Catalin, specialists in the development and manufacture of foundry products — willing and able, moreover, to advise upon their applications. What he has to say is important to you, because he can show you how Catalin materials will improve your castings — and save you money. A day with him is a day well spent. Call in the Catalin man to discuss your problems.

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finish and

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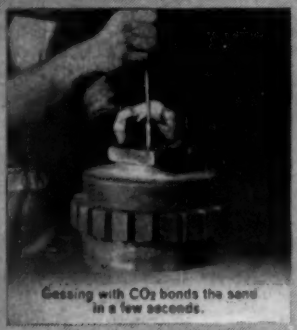
FTC

sand cores for die castings

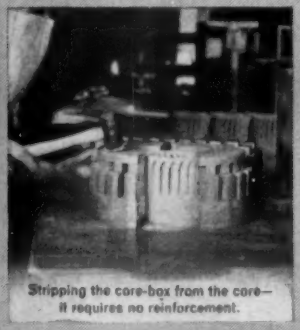
bonded by the CO_2/silicate process

Assembling the core-box.

Finishing the core, rammed with sand silicate mixture.



Gassing with CO_2 bonds the sand in a few seconds.



Stripping the core-box from the core—it requires no reinforcement.

Oven drying is completely eliminated. Core boxes (or moulding patterns) are re-usable immediately.

DCL

Core release from the casting is easy and speedy.

The CO_2/silicate process offers simplicity, versatility and dimensional accuracy in the economical production of cores for die castings. This picture sequence shows how simply an aluminium casting was made by H. J. Maybrey & Co. Ltd., for Plannair Ltd., Leatherhead.

for details of the

CO_2/SILICATE PROCESS

write to

The Distillers Company Limited, Chemical Division, Carbon Dioxide Department, Devonshire House, Mayfair Place, Piccadilly, London, W.1. Tel: MAYfair 8867

Sales Offices:
Southern Area: Broadway House, The Broadway, Wimbledon, London, S.W.19. Liberty 4661
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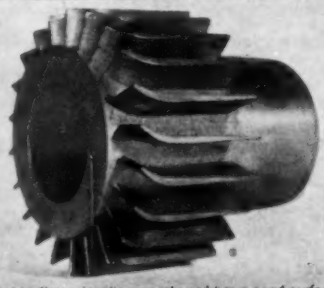
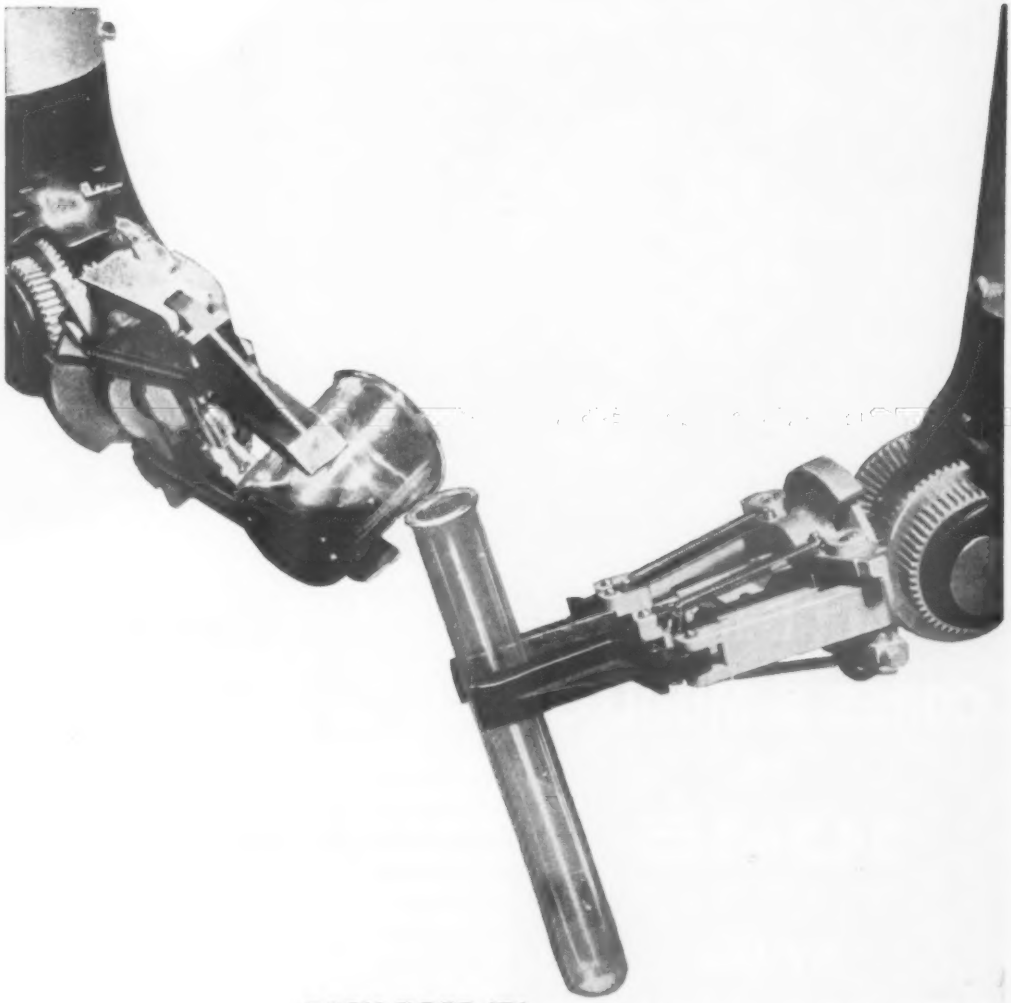


The casting is dimensionally accurate and has a good surface finish.

TA/3913



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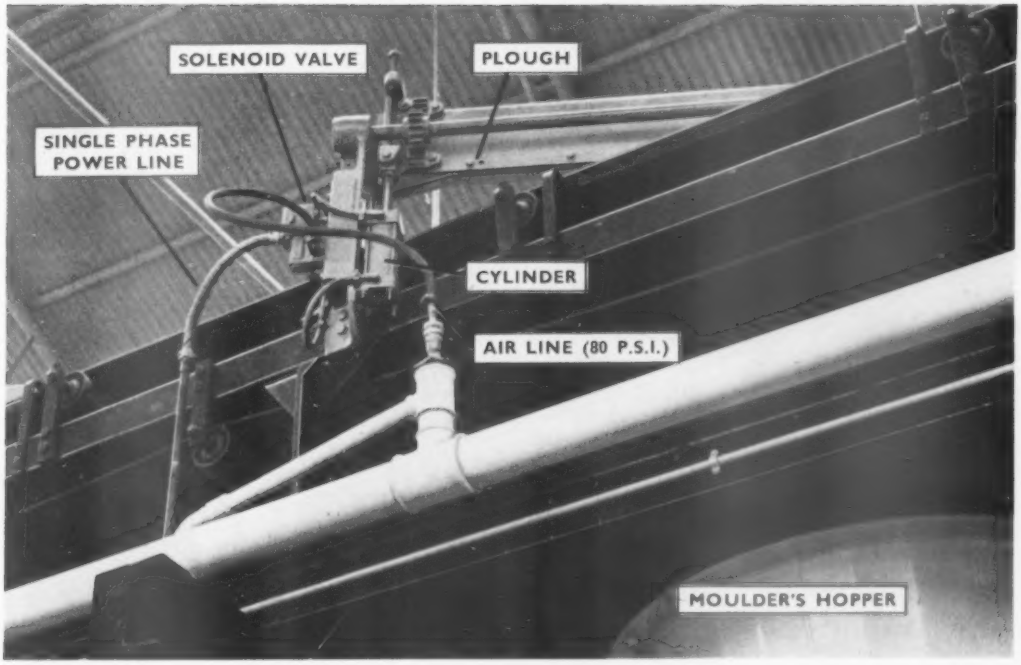
AUTOMATIC PLOUGHS WITH ELECTRONIC HOPPER LEVEL INDICATORS

Europe's Foremost Designers and Manufacturers of Foundry Equipment install many Electronic Hopper Level Indicator and Automatic Plough Systems in Mechanized Plants

ILLUSTRATION ABOVE SHOWS VIEW OF SANDHANDLING AND DISTRIBUTION PLANT WITH TWIN OVERHEAD CONVEYORS FITTED WITH 16 *AUTOMATIC AND ELECTRONIC PLOUGHS*—ELIMINATING "*THE MAN OVERHEAD.*" *(PHOTOGRAPH BY COURTESY OF LEY'S MALLEABLE CASTINGS CO. LTD., DERBY.)*

TESTED AND APPROVED



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Our tested electronic and automatic device cuts labour, reduces effort, improves production, and is a step nearer automation in the foundry. Whether you have two or twelve hoppers our patented system eliminates hand control and "the man overhead" and ensures that every moulder has a supply of sand all the time.

Sensitivity of operation and greater degree of precision of plough control enables total throughput of prepared sand to be reduced for a given mould output.

A proved system "signals" for sand which is delivered to each hopper but not at the expense of another moulder. The plough itself is operated through a TAL-Numatics Solenoid Valve—the valve proved through millions of cycles.

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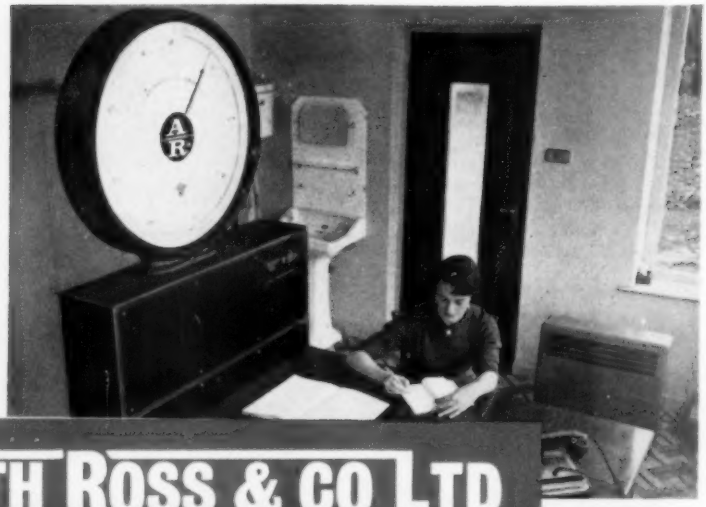
Stage by Stage...



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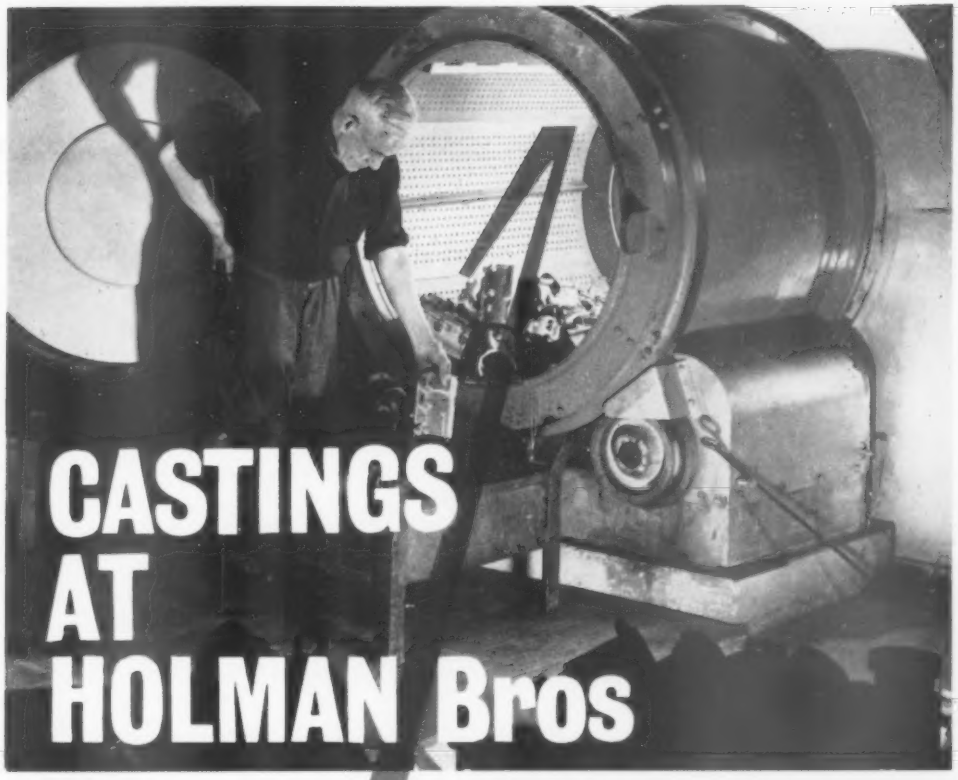

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The unit, one of over five hundred giving satisfaccion throughout the world, has been in operation since 1952 helping to maintain the impeccable standard set by Holman Bros.—whom we gratefully thank for permission to reproduce the photograph.

We will gladly demonstrate the possibilities of the Centriblast Barrel on your own work—please contact us to arrange the details.

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Pawney/S.27

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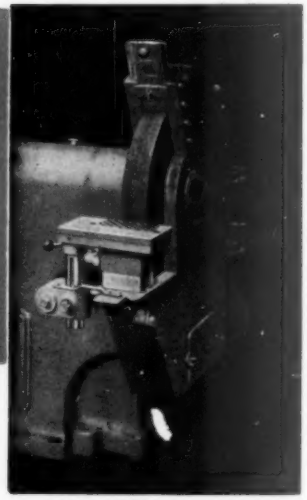
F.13

FOR IRON FOUNDRIES
Wheel hoods as developed by the British Cast Iron Research Association can be fitted.

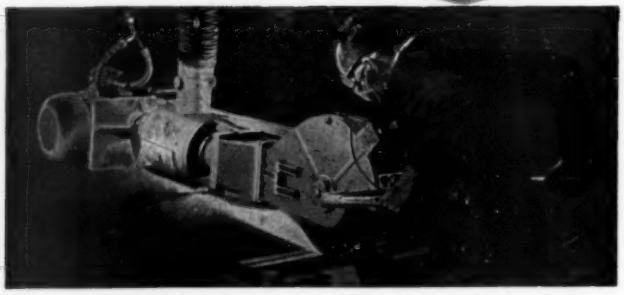
ALL COMPLYING WITH THE 1953 IRON & STEEL FOUNDRIES REGULATIONS

Luke & Spencer Ltd., manufacture a large range of pedestal and swing frame grinders with wheels from 12 inches to 36 inches diameter.



This 16 inch high speed swing frame grinder completely eliminates the dust problem. The dust is taken up at the point of suspension to ensure machine control and balance. It has been filmed in operation by the Factory Inspectorate and complies with all revelant regulations.

FOR STEEL FOUNDRIES
Wheel hoods as developed by the British Steel Castings Research Association can be fitted



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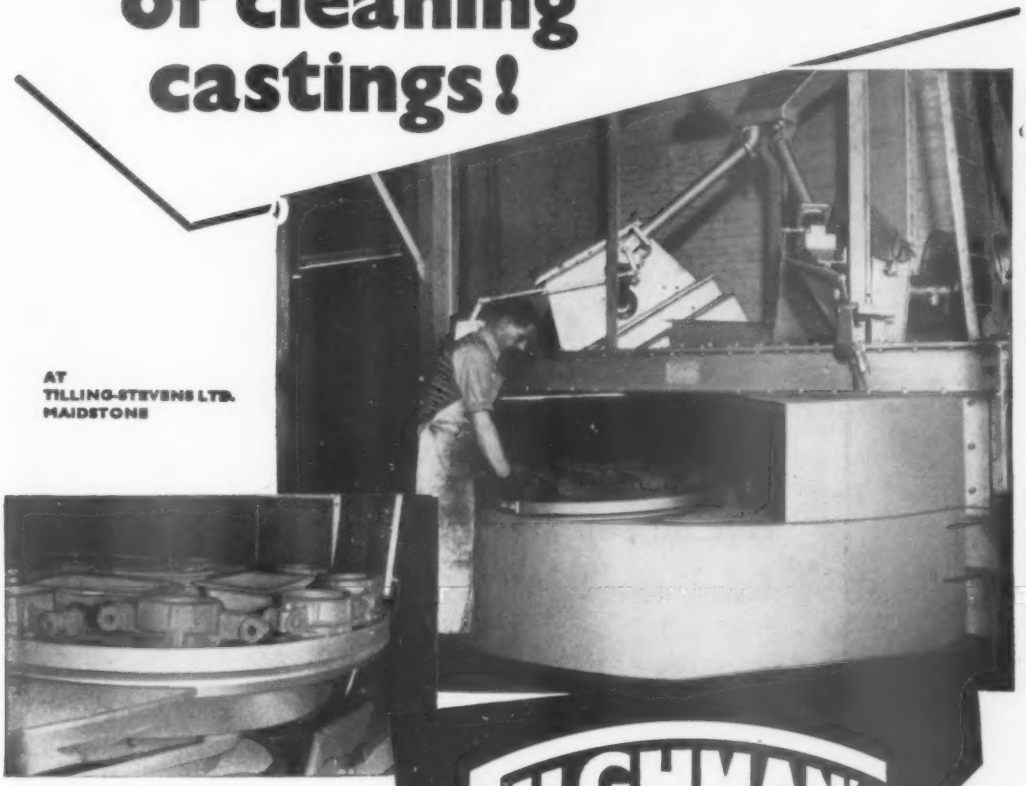
The fastest method of cleaning castings!



AT
TILLING-STEVENS LTD.
MAIDSTONE

These pictures show that Tilling Stevens Ltd., of Maidstone know the most up-to-date and efficient method of removing sand and scale from castings. The components are cast iron suspension unit brackets for armoured fighting vehicles, and are blasted continuously on the rotary table in a 4 minute time cycle. The model shown is WMT4, just one of an extensive range which sets the highest standards yet known in abrasive cleaning. There are Wheelabrator Shot Blast Machines in types and sizes to suit all general applications, in addition to which much special plant has been designed to meet specific requirements.

TILGHMAN'S

ROTARY TABLE — AIRLESS

WHEELABRATOR

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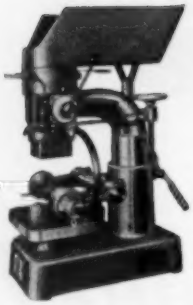

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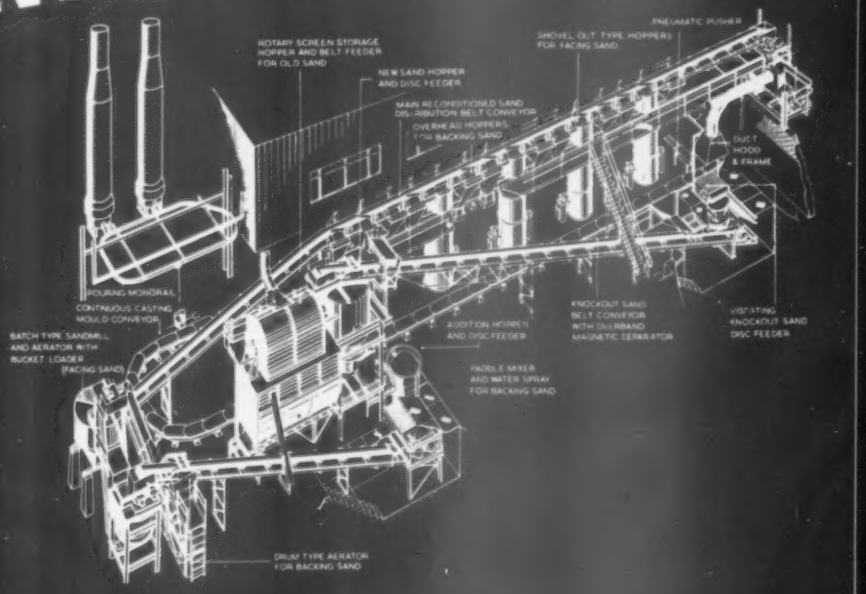
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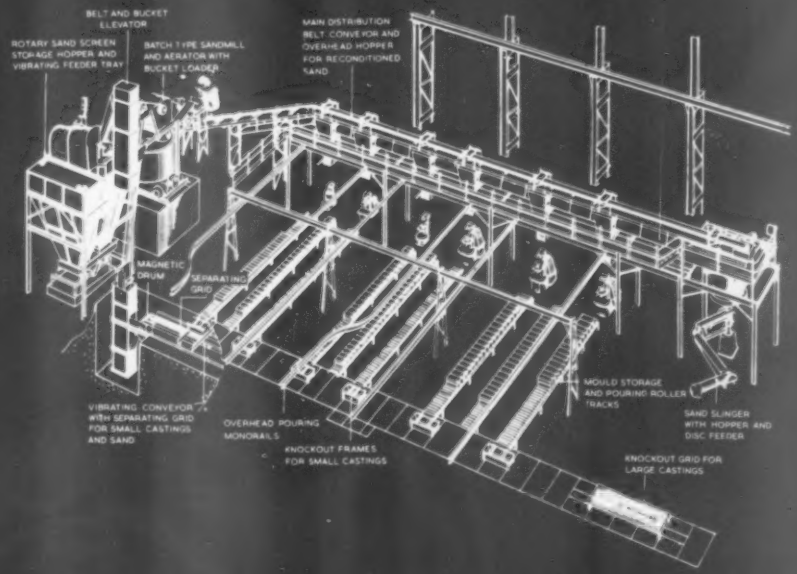
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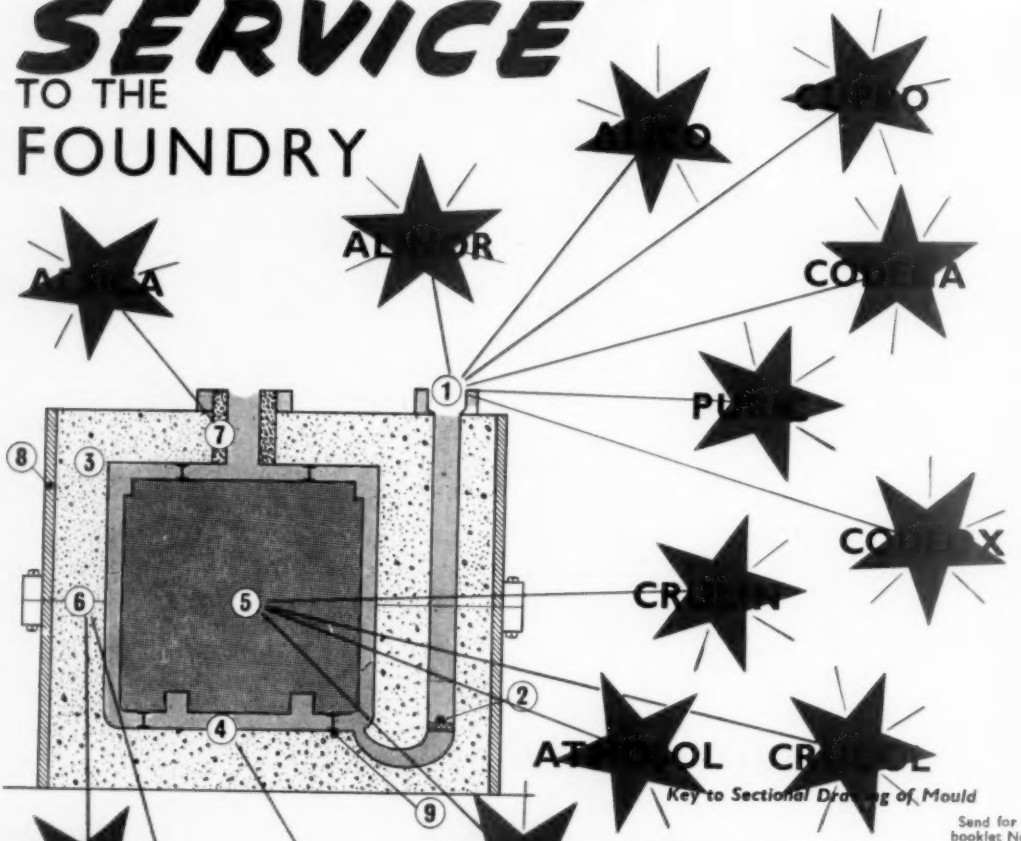

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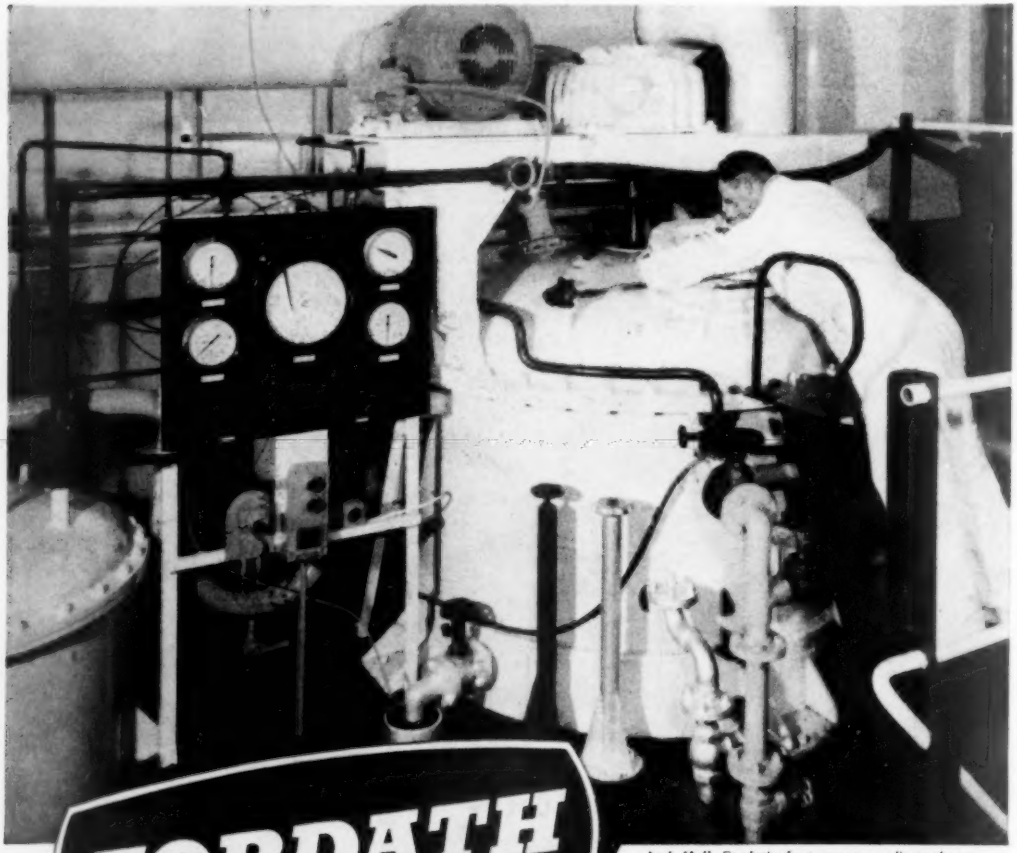

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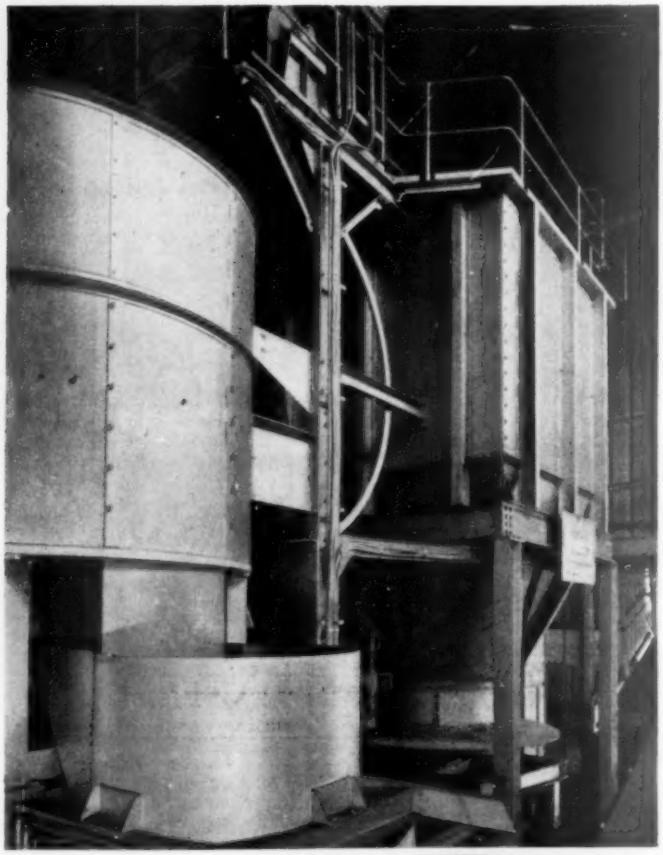

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Iron Castings Market Development

Following discussions which have been taking place in recent months on the question of the market for iron castings, the February *Bulletin* of the Council of Ironfoundry Associations announces* a decisive step forward which will be welcomed by progressive ironfounders. This body has set up a strong Market Development Committee stemming from the initiative of the National Federation of Engineering and General Ironfounders, which covers the activities of the National Ironfounding Employers' Federation and the Ironfounders' National Confederation. It is stated that the proposals envisage bringing to the forefront the technical merits and possibilities of iron castings, and the line of approach is significantly indicated: "To achieve success will involve much hard field work of a highly technical and expert kind; the end-product would be published as technical information and data and would be of a quality to command the consideration and respect of engineers and designers." The proposal is for the benefit of all sections of the industry and it is hoped that other trade associations in the industry will co-operate. There is no conflict of interest between the jobbing foundries and the specialist foundries, or indeed between the independent and the captive foundries attached to manufacturing organizations, since all seek the most economical solution to their problems.

The success of the iron casting in the past has obscured to some extent the fight which the casting had to establish itself against wrought material and other casting alloys which came earlier in historical development. Its advantage as the shortest cut for the engineer from raw material to finished product unfortunately encouraged founders to take the market largely for granted and induced a measure of complacency. Nowadays, a new generation of engineers and designers is able to exercise a much wider choice of alternative materials, for the application of which they have in some cases been supplied with much technical data. Yet, research and development have in large measure vindicated the merits of the iron casting and expressed these advantages in scientific and quantitative terms, and a mass of information is available for this new and legitimate activity—possibly the last major link required in organizing the ironfoundry industry on a material basis. Such activities have been a feature of foundry trade associations overseas in recent years, especially in Western Germany and America.

In wishing success to the venture, we would commend the approach which would press the use of the material to the limit of its economic and technical potentialities. That these are not at present reached is the primary reason for the new activity, but the parallel developments in the industry with respect to education, training, research, development, and public relations should give confidence in its capacity to meet the most exacting requirements which may be called for. Such developments are closely connected with the user-demand aspect of market research, and should ensure that designers are able to compare alternative materials of to-day with the casting of to-day rather than that of yesterday.

* An announcement also reported in the JOURNAL of February 9, page 178.

Soviet Trade and Industry Exhibition

The Soviet Trade and Industry Exhibition, to be held at Earls Court, London, from July 7 to 29, promises to be an outstanding event of the year. It will occupy the whole of the ground floor of the building and about half the first floor. It would appear that it is to be more of an exhibition than a trade fair, as many of the latest Russian developments, such as the exploration of outer space, will be shown as models. Two large areas, each of 22,596 sq. ft., will be devoted to culture and handicrafts, carpets, fashions, textiles, food and household goods. Foundry interest will be centred in the ferrous and non-ferrous metallurgy sections, and in this connection industrial films are to be shown. About 300 Russians are coming to the UK to man the stands at the Exhibition. A special trade bureau has been arranged to deal with commercial questions and experts will be available to answer technical questions. Prices of admission will be 3s. 6d. for adults, children at half-price. For trade buyers invitations will be sent from the Trade Commissioners' office.

Forty Years Ago

The FOUNDRY TRADE JOURNAL in its four issues covering February 1921, dealt in an optimistic vein with really bad trade conditions. During the period under review, the British Cast Iron Research Association was officially registered and opened its offices at Central House, New Street, Birmingham. This fact encouraged the Editor to assert that a new era was opening, when waster production would be materially reduced. Also reported in these issues was a dinner of the Newcastle branch of the Institute of British Foundrymen at which the creation of the Mayer Medal awards were announced. Whilst there were some good practical papers published, the month's technology was otherwise undistinguished. To mark the changeover of the JOURNAL from a monthly to a weekly publication, a competition was announced for the best account of design and equipment of a foundry, with special reference to the latest labour-saving devices and machines, internal transport and handling tackle. (Prizes of 30 and 20 guineas were subsequently awarded for schemes submitted by Mr. L. J. Tibbenham (Suffolk Ironfoundry (1920), Limited) and Mr. H. Lewin of Ivy Cottage, Old Whittington, Chesterfield).

Hungary's Industrial Programme

Hungary is to spend 2,482 million forints—about £74 million—on expanding her machine and iron and steel industries this year. More than a third of the 1,107 million forints earmarked for the machine industry will go on the completion of 25 industrial projects now in hand. A quarter will go to expansion of high-voltage power plants, 16 per cent. to developing the country's diesel-building programme, and 16 per cent. to improving plant and equipment in telecommunications engineering. A third of the iron and steel industry investment will go on a single project, the Danube Iron and Steel Combine at Sztálinváros where most of the money will be used on the cold rolling mills, due for completion in 1963. Another large slice—31 per cent.—will go on the reconstruction of the important Ozd Foundry Works, in the north. Projects due for completion this year include aluminium rolling mills in the Csepel combine, Budapest, a plant for utilizing natural gas at the Lenin Foundry Works at Diósgyor, and an oxygen plant at Ozd.

Forthcoming Events

MARCH 1

Combustion Engineering Association

Three papers on the "Automatic Boiler House": (1) "Research by the British Coal Utilization Research Association," by G. G. Thurlow; (2) "Instrumentation and Control," by R. F. Hirsh, and (3) "Problems of the User," by Alan Wilson, 10 a.m.—open discussion 2 p.m. Meeting at the Grand Hotel, Charing Cross, Glasgow.

Institute of British Foundrymen

Southampton section: "Development of Cast Metals," by Dr. H. T. Angus, 7.30 p.m., at the Technical College, St. Mary's Street. (Joint meeting with the Southampton Metallurgical Society).

Institution of Production Engineers

London section—Brighton group: "Economics of Materials Handling," by A. G. Hayek, 7 p.m., at the Old Ship Hotel, Castle Square, Brighton.

MARCH 2

Institution of Production Engineers

Rochester graduate section: "Operational Research," by D. Hicks, 7.30 p.m., at the Old Palace, Maidstone, Kent.

Institute of Metals

London local section: "Progress in the Electron Theory of Metals," by J. A. Catterall, 6.30 p.m., at 17, Belgrave Square, London, S.W.1.

Leeds Metallurgical Society

"Grain Size—Three-quarters of the Key to Strength?" by Prof. N. J. Petch, 6.30 p.m., at the University Staff House, University Road, Leeds.

MARCH 4

Liverpool Metallurgical Society

Eighth annual conversazione at the University Club, Liverpool.

Latest Foundry Statistics

Steel Castings: Monthly Statistics, published jointly by the Iron and Steel Board and the British Iron and Steel Federation, reports that employment in the steel foundries stood at 18,880 on December 10, 1960, showing an increase of 80 over the November figure and 1,210 more than a year earlier. The average weekly output of steel castings was given—provisionally—as 5,700 tons, which as is usual was lower than the November figure—estimated at 6,400 tons. The output for 1960, which is estimated to be 300,000 tons, is well up on the 1959 total.

Copper-base Castings: Pleasing results for 1960 are reported in the February *Bulletin* of the British Bureau of Non-Ferrous Metal Statistics. It shows that the output of copper-base castings during the year was 88,977 tons or just over 14,000 tons more than in 1959. The December output was 7,606 tons, which despite the Christmas holiday, was higher than the monthly average.

IVE Annual Conference

Arrangements are now in hand for this year's annual conference of the Institute of Vitreous Enamellers, which is to be held at Harrogate on May 24 to 27. The conference will begin with a reception and the opening of the trade fair "Confair 1961." Included in the programme of entertainment, which has not at this stage been finalized, will be an interesting excursion for the ladies, and an item "a little out of the ordinary." The Friday has been set aside for technical papers with a gala dinner/dance in the evening. The annual banquet, which will be held this year in the autumn, in London, will not form part of the proceedings.

Control of Foundry Steelmaking*

By J. Blackburn, F.I.M.

The objective of technical control of steelmaking is to establish a sound fundamental practice and then (in each and every heat) to record sufficient observations to confirm that the practice has been carried out. First, the Author deals with raw materials used in foundry steelmaking (such as scrap, ferro-alloys, and fluxes) with particular emphasis on scrap—one of the most important raw-materials—and dealing with the chief items for control of scrap, i.e., quantity, composition, physical condition, and segregation. Next, Mr. Blackburn deals fully with the method of charging a furnace and working the melt, the composition of the bath and slag, followed by notes on the oxidizing and the reducing periods. Finally, the Author lists the duties of supervisory staff, the main one being to translate specifications and metallurgical theories into practice on the furnace stage.

A large amount of research work has been devoted to steelmaking operations with the two main objects of improving steel quality and reducing production cost. Production of ingots is many times greater than the tonnage of steel castings and, not surprisingly, most research has been applied to problems related to the manufacture of steel for ingots. Fortunately, much of it is applicable to foundry steelmaking: the aims are the same, to make the best quality steel in the quickest and cheapest way. In recent years, much useful work has been done on foundry steelmaking, both by the British Steel Castings Research Association and by steel foundries themselves, and a considerable volume of literature exists on the subject.

The difference between ingot and foundry steelmaking are not basically technical; they are related rather to the scale of operations and to the way in which the steelmaking operation fits into the whole production scheme. The steelworks melting shop sets the pace of production for the entire works and absorbs a big proportion of the total production cost. On the other hand, in the steel foundry, the moulding, rather than the melting department, usually sets the production pace. The size of furnaces is a compromise, since there must be sufficient holding capacity to cast the biggest single casting the foundry makes, but it by no means follows that all the furnaces can be run at maximum capacity all the time. Furnaces are expected to work with charges from about 60 to 200 per cent. of rated capacity, and many foundries work dayshift only. All these factors affect efficiency, but they are matters of organization and administration and cannot be materially influenced by technical control.

The foundry expects to receive liquid steel (*a*) at the right time (*b*) in the correct quantity (*c*) of the correct composition (*d*) at the right temperature, and (*e*) at the lowest cost. The machinery by which this is achieved is, first, by control of raw materials and, secondly, by control of the process. Purely technical considerations are not the only factors to be considered. Just as the foundry's reason for existence is to make money, not castings, so the melting department's job is to make, or at least save, money by a judicious blend of technical and commercial thinking. In other words, the "technical" part of technical control should not be considered as holier than "control." The small size of most steelfoundry melting departments tends to support the dual role of supervisors; men who are basically technicians often have to double in the roles of labour controllers, buyers and department administrators.

Steelmaking processes used in steelfoundries at the present time are few in number. The arc furnace is by far the most popular, usually with a basic lining, with the Tropenas converter still surviving to some extent, and the acid open-hearth in a few foundries, mainly for larger casting. Induction furnaces, mainly of the high-frequency type, represent the purely melting type of furnace. The arc-furnace plant can be taken as typical of the truly steelmaking types of furnace, and the high-frequency furnace as a representative remelting furnace. Control schemes for the two types of plant differ in emphasis, rather than principle, and so can be considered together.

To make good steel for the foundry is not nearly so difficult as the great volume of literature on the subject may suggest. What is difficult is to avoid making the odd bad heat, not knowing it is a bad heat until it has cost a lot of money only to become scrap castings. The object of technical control is therefore to establish a sound fundamental steelmaking practice, and then, in each and every heat, to record sufficient observations to confirm that the practice has been carried out. These observations are of two kinds, of quantity and of quality, and are shown in diagrammatic form in Fig. 1. They can be recorded on a log sheet, the design of which is of some importance, because it must not merely provide easy means of recording all the separate items of information, but it should also facilitate the analysis of both quantity and quality information.

* Paper presented at the 1960 conference on technical-process control organized by the British Steel Castings Research Association. The Author is attached to Bonnington Castings, Limited.

Control of Foundry Steelmaking

Raw Materials

Scrap

Steel scrap is by far the most important raw material used in steelmaking. It accounts for about half the total cost of liquid steel and its quality influences the performance of the melting furnace. The chief items for control of scrap are:—(*a*) quantity; (*b*) composition; (*c*) physical condition; and (*d*) segregation.

(*a*) *Quantity.*—Steel foundries usually carry a stock of several weeks' supply of bought steel scrap amounting to several hundred tons. Once this scrap goes into the stockyard, it is virtually impossible to reweigh it in bulk or to estimate its weight with any accuracy; hence, the actual stock can only be obtained by recording incoming weights accurately, taking precautions against carelessness and dishonesty, and weighing the scrap carefully into the charge. It is often difficult to make operators appreciate that not only must the total charge-weight be correct, but that the constituent parts of the charge must also be accurately weighed. Foundry return scrap is not quite such a problem from the quantity point of view. It is unusual for a weighing operation to take place before charge preparation; likewise, stocks of return scrap are usually kept low.

(*b*) *Composition.*—Technical and economic factors influence the selection of scrap by composition. Sulphur and phosphorus contents are the commercial yardstick of "purity." The lower these two elements are, the lower the metallurgical load on the furnace, and the cheaper the conversion operation, but, of course, the dearer the scrap. Scrap merchants' assessment of scrap quality is notoriously unreliable and it is not possible to make a clear decision to use "0.04" or "0.05" scrap knowing that the quality will tidily fall into these two categories. Furthermore, the presence of even a small proportion of stray cast iron scrap can increase the phosphorus content of a charge sufficiently to delay the steelmaking operation. Sampling and analysis of loads of scrap, while necessary, can never guard completely against this kind of contamination, but do at least keep scrap suppliers "on their toes" and show up their grosser impositions. Uniformity of scrap quality so far as possible is desirable. If a continuous supply of process scrap is obtainable, so much the better: miscellaneous scrap is variable in composition and difficult to handle within a standard steelmaking procedure.

Steel turnings can be useful scrap, but may be covered with cutting oil with a high sulphur-content, much of which enters the steel during melting. Degreasing of turnings for analysis removes this sulphur source and it may be difficult to account for a mysterious sulphur pick-up. Excess oil should be removed by centrifuge before delivery. There is a danger of carbon and alloy-steel turnings being mixed and special care is needed in sampling and analysis.

(*c*) *Physical Condition.*—Scrap is scrap and cannot be expected to be nicely shaped and sized, but obviously heavy, clean scrap in pieces short enough to pack into a dense charge is better than light, very rusty material in long pieces. The top-charged furnace is tolerant of oversized scrap within reason and provided the entire charge can be charged into the furnace at one go, there is no objection to a part of it consisting of big pieces. Really oversize scrap must of course be cut, preferably before delivery. Scrap cutting in the foundry stockyard is an excellent illustration of Parkinson's Law: there is always enough cutting to occupy all the cutters employed.

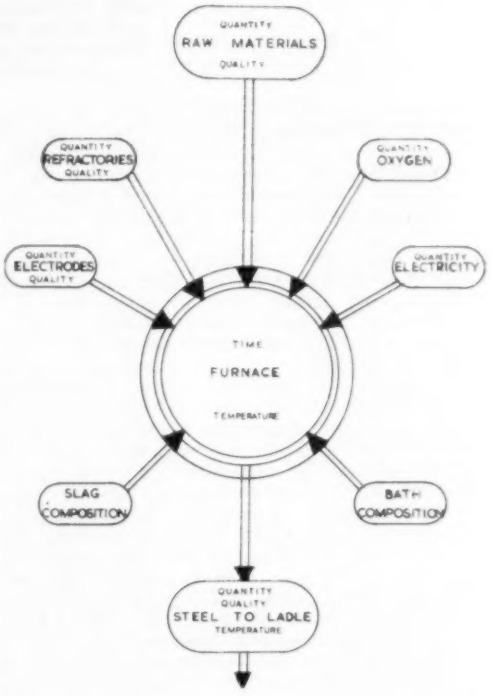

FIG. 1.—*Technical control diagram governing steel-melting processes in regard to quality and quantity.*

Turnings vary widely, from heavy short chippings to light bushy tangled messes, almost impossible to handle by magnet, or, in fact, in any other way. The latter should not be allowed into the works: if, unfortunately, they are generated within the works, they should pass through a crusher before being accepted by the stockyard.

Foundry returns will generally have been shot-blasted for ease of flame-cutting and will thus be free of sand. This is important: in a basic furnace, sand attacks bottom and banks and requires much lime, and possibly an extra slag-off before a useful

basic slag can be made. In an acid furnace, it can produce a large and unworkable slag volume. In both cases, it results in alterations to the standard melting practice, costly in time and material and upsetting to the foundry production programme.

(*d*) *Segregation.*—The problem of segregation of varieties of scrap according to composition is always a difficult and important one, but especially difficult in the case of purely melting plants. Not only must the foundry return-scrap be segregated into as many bins or bunkers as there are steel specifications, but bought scrap must also be segregated by composition. For this reason, a source of process scrap which can be relied upon to remain constant is desirable; miscellaneous scrap is far too variable. A stockyard for this type of plant requires a large number of small-sized bins or bunkers.

Arc furnaces are less demanding in the matter of segregation. All bought carbon-steel scrap of acceptable sulphur and phosphorus contents can be stored together; likewise, all carbon-steel return-scrap, together with 1½ per cent. manganese-steel scrap, can be stored together. A small number of bins will enable alloy scrap to be stored in groups of specifications, *e.g.*, molybdenum steels, nickel steels, nickel/chromium/molybdenum steels and chromium/molybdenum steels. These need not be very large, since return scrap is used practically as it arises, much of it in fact never going into the bins, but being loaded straight into the charging baskets. Segregation of foundry return-scrap, however, begins at the cutting stage, and the only workable solution appears to be to paint *all* runners and feeders before cutting, using a code of paint colours to differentiate between different steel-compositions. Such a scheme, simple in principle, still needs a constant effort to ensure that it is maintained. A lapse of even half a day can result in a considerable number of heats becoming "misfits," which are often unsaleable.

Ferro-Alloys

Compositions of alloys as declared by suppliers are usually reliable, but check analysis is a sensible precaution and enables a certain amount of selection to be done, *e.g.*, low-phosphorus lots of high-carbon ferro-manganese can be reserved for austenitic manganese heats, and very low carbon batches of low-carbon ferro-chromium can be set aside for very low-carbon stainless-steel heats. Physical control of alloys is purely a storekeeping job. Storage of these materials, some of them expensive, must be secure, and weighing and recording accurate. Good scales are essential, and operators should be trained to weigh the exact quantity called for. A system of ordering chits sent from furnace to alloy stores for bath additions helps to avoid mistakes, and helps also in stock control. In any case, the stocks of dearer alloys, nickel, ferro-chromium, ferro-molybdenum, ferro-vanadium, ferro-columbium, etc., should be physically checked at weekly or, at most, monthly intervals.

Fluxes

Lime or limestone are valued according to their CaO content and, inversely, with their contents of other compounds, including water. Both lime and limestone have their adherents among steelmakers, and either can be used successfully. Freshly dead burned lime is free from moisture, but hydration begins immediately and by the time lime arrives at the furnace, even if not visibly "falling," does contain a significant water-content, which, while not particularly deleterious during the oxidizing part of the melting cycle, is definitely harmful as a source of hydrogen during refining. One solution, commoner in the USA than in Britain, is to buy lime in sealed drums, which are opened on the furnace stage when actually required. The size grading of lime deserves some attention; small chippings of ½ to 1 in. are ideal as this size fuses easily, but, of course, the smaller the size, the more surface area is exposed to hydration. If lime is used, it should be bought frequently in small quantities, covered in transit, and stored preferably in a closed vertical bunker so that there is no dead stock. Chemically, lime is usually reliable, since only good quality limestone is burned for lime production, but occasional checks of CaO, SiO_2, MgO, water and sulphur contents are advisable, and the actual values obtained are useful in calculating slag additions.

Some steelmakers prefer limestone because it does not hydrate and only carries moisture on its surface, though it can be argued that a melting furnace is an expensive way of calcining limestone. It is less likely than lime to float in the slag in unfused lumps and less likely to cause the hearth to "grow" when charged direct on the bottom.

The composition of limestone cannot be taken for granted. It may be almost pure calcium carbonate, a high-magnesia material similar to dolomite, or a roadstone with a CaO/SiO_2 ratio no greater than that of a mildly basic slag. It is best to examine samples from a number of areas before selecting one, and limestone producers who convert some of their output into lime will be likely sources of supply. Occasional checks of CaO, SiO_2, MgO, Al_2O_3 are sufficient to confirm that quality is maintained, and size grading should also be checked from time to time. Chippings of ½ to 1 in. cost little more than cupola-size limestone and are much easier to use in the average furnace. Fluospar is bought in the washed and graded state with a guaranteed minimum fluoride-content. Anthracite, provided it is anthracite of low-volatile content, can be accepted without further checking.

Electrodes

The cost of electrodes represents 15s. to 25s. per ton of liquid steel, so they are worthy of care and attention from the time of receipt. There is some evidence that the usage of electrodes is affected by their electrical conductivity and a simple method of checking this has been devised[3]. Checking should be done at the time of receipt of a batch of electrodes, at the same time, diameters should be gauged and screw threads and ends examined for damage. After inspection, electrodes should

be stored in a dry, warm place, preferably so that they will not require handling again until they are fitted to the furnace.

Refractories

Steel foundries rarely have the staff, the facilities, or the consumption of refractories to justify much acceptance testing of deliveries. Similarly, new or different materials cannot be scientifically investigated and the approach is rather one of trying in practice combinations of types of refractories, suppliers, and techniques of use, and recording performance in terms of usage per ton of steel and cost per ton of steel. The emphasis, therefore, is upon recording accurately quantities, costs and performance of the various refractory materials available, taking full advantage of published work, and of the very valuable operating experience of other foundries.

Most of the materials are stable, and only require dry storage. Dolomite, however, and semi-stable dolomite bricks deteriorate through hydration and must be ordered as required with precautions against dead stock building up.

Charging the Furnace

The way a charge is prepared for a furnace has an effect upon the efficiency of both the melting and refining parts of the cycle. For a top-charged basic arc furnace, the charge should:

(*a*) Drop into the furnace without damage to the hearth; (*b*) be of such bulk density that one basket charge will fill the furnace almost up to roof level without needing too much levelling to get the roof back on, and be of the correct total weight; (*c*) allow maximum power-input for as big a proportion of the melting period as possible without damage to refractories, and (*d*) melt out to produce a clear melted bath of sufficiently high carbon content, relatively cold, and covered with a sufficient volume of highly-basic well-oxidized slag, thus facilitating removal.

Example:

$CaO:SiO_2$ ratio: 2.2 to 2.8.
Temperature: 1,450 deg. C.
Carbon content: 0.20-0.30 per cent. above final carbon required.

It is an important technical control function to ensure that charges are uniform within these requirements, so that good quality steel can be made with the minimum time-consuming deviation from the standard steelmaking practice. The first two points are governed by the physical make-up of the charge. Broadly speaking, a layer of light scrap or turnings at the bottom of the basket, followed by heavy scrap, and topped up by more light scrap and/or turnings should be the order of charging. It is difficult to be sure that charges are prepared in detail in the manner laid down; provided the total weight is correct, there is no proof of the make up of that weight. A ticket-printing weighbridge is of value in this respect and a charge ticket issued as the channel of instruction to the stockyard forms a useful record for both technical and stock control purposes.

The third point is a function of physical make up of the charge. As long as the sidewalls remain covered with more or less vertical lining of unmelted scrap, not only is thermal efficiency high, but high voltages with long arcs can safely be used as the sidewalls are protected.

Lastly, the melt-out slag can be adjusted by limestone added to the charge, or to the furnace during melting, the carbon content by anthracite or scrap electrode addition to the charge, and the slag FeO by feeding ore into the furnace just before clear melt.

Working the Melt

Once the charge is in the furnace, the object is to melt it as quickly as possible, *i.e.*, to make the charge absorb as much power as the electrical equipment can deliver. Control at this stage depends upon the furnaceman; the voltage tappings of a furnace are fixed and the best he can do is to carry the highest voltage as long as is safely possible. In this respect, a recording kwh meter is a useful instrument, not so much in working a particular melt as in providing a number of charts whose pattern can be studied in order to arrive at a basic procedure. Recently, BISRA have developed an automatic power-input control (APIC) unit for arc furnaces[2] which promises improvements in melting rate and electrical-power consumption by control of power input. This development should in future provide a valuable additional tool for technical control of arc-furnace steelmaking.

For the present, the furnaceman carries on melting until most of the charge is liquid, and the banks and sidewalls are still largely covered with scrap. Using his skill and experience, he selects the right time to pull in this scrap with rakes, sometimes with the help of oxygen, so that the scrap is dissolved, leaving a completely molten bath, at low temperature, covered with a sufficient bulk of slag of suitable composition to start the work of refining.

At this stage, it is timely to consider just what is being attempted. The refining cycle is divided into two parts, the oxidizing period in which carbon, silicon, manganese, phosphorus and hydrogen are removed and the reducing period, in which oxygen and sulphur are removed and ferro-alloys added to meet the final specification. Most of the reactions take place *via* the slag and proceed quickly in the oxidizing period because of the turbulence of bath and slag. In the refining period, reactions proceed more slowly since there is little or no circulation of bath or slag except that produced by manual rabbling or by electro-magnetic stirrers. There is an optimum temperature for each stage of the cycle. Ideally, the correct tapping-temperature and composition should be reached at the same time, and again ideally, a continuous record of bath composition, including gas contents, and a continuous record of slag composition. None

of these is possible at present and it is unlikely that any of them will be in the foreseeable future. The control checks available are either spot checks or empirical or inferential tests requiring intelligence in their application and timing.

Temperature

Of all types of pyrometer, only the immersion rare-metal thermocouple with quick-acting indicator or recorder is worth serious consideration. This is unfortunately "messy" because a new silica-sheath is needed for every dip; it is also expensive, costing about 2s. to 3s. per dip. Obviously, timing of dips must be planned intelligently, and all precautions must be taken to ensure that the readings obtained do really represent the actual bath-temperature. In the reducing period particularly, repeated and thorough rabbling is absolutely necessary; an actual record of temperature and composition variations throughout the bath at this stage would probably give most steelmakers an unpleasant shock.

Composition of Bath

Although continuous analysis of the bath is not possible, the spectograph and, more recently, the X-ray spectrometer, do enable very quick estimations of some elements to be made[3]. Such instruments are, however, out of reach of the average steel foundry which could not provide sufficient work to keep them fully employed. Bath composition must, therefore, be judged by quick analysis using orthodox methods of bath samples drawn at definite stages of the melt. For example, on clear melting a sample analysed for carbon, manganese and phosphorus will establish that the carbon is high enough to provide the required boil, the manganese is not high enough to inhibit the boil, and the phosphorus is such as to require one or two slag-offs. Stable elements, such as nickel or molybdenum, can be checked at any time. Similarly, a sample drawn after final slag-off will give the lowest values of all elements, except sulphur, and can be used to calculate ferro-alloy additions. It is quite possible to do all the bath analysis required by normal wet and combustion methods, but estimations can be speeded up by using the newer techniques, such as the absorptiometer. While, however, speed of analysis is important, of at least equal importance is the cycle of operations between drawing the sample from the furnace and delivering it in a suitable state for analysis to the laboratory. Sampling begins with taking a few pounds of steel in a well-slagged spoon from the furnace, deoxidizing with aluminium in the spoon and then either pouring it into a cast-iron chill mould, pouring it into a rotary sampler[4], or sucking a quantity into a glass tube by means of a rubber bulb. For any but the most undrillable steels, the pot sample, drilled to provide a sample, is probably the most satisfactory. The drilling machine, preferably located on the furnace stage, should be really large and heavy, fitted with robust hand-feed and capable of driving a 1 to 1¼ in. flat drill at low speed, say 150 to 200 rev. per min. Such a machine will drill most bath samples if care is taken in cooling, high-carbon or alloy specimens. Drillings can be sent to the laboratory by hand or pneumatic tube within 3 or 4 min. of drawing the sample and a carbon figure reported back in a further 2 to 3 min. The time when a sample is drawn should be noted on the heat log sheet, and the elements recorded as received. During boiling of carbon-steel, particularly where oxygen injection is practised, the fracture sample should by no means be ignored since it gives a quick carbon figure with reasonable accuracy.

Bath analysis omits an important composition factor, that of gas content, in this context referring particularly to oxygen and hydrogen. It is known that hydrogen concentration is reduced during the boil and then increases progressively from slag-off to tapping, and that excessive hydrogen can cause pinholes when the steel is poured into greensand moulds. Similarly, excessive oxygen in the finished steel, either in the form of gaseous compounds or solid oxides, causes gas holes in castings or impairs physical properties. Unfortunately, analysis of gases-in-steel is a slow operation, not at all practicable as a bath-sampling technique. The steelmaker is quite ignorant of the hydrogen content of the melt he is working, and has only indirect evidence of the oxygen content, and must, therefore, rely entirely upon a sound steelmaking practice. Considering the number of papers published on the subject of hydrogen in steel, this is a startling admission. Possibly the recent developments in vacuum melting and vacuum treatment of steel will encourage the introduction of new quick methods of gas estimation in steel which would, in turn, promote useful experimental work on methods of removal.

Slag Composition

In an oxidizing slag, the lime/silica ratio and the FeO content are important; in a reducing slag, the lime content, the calcium-carbide content, and the relative freedom from iron and other metallic oxides are most significant. Slags change their composition so quickly that actual analysis of slag samples during the progress of a melt is rarely attempted. Much can be deducted from the appearance of slag; a rabble passed through the bath and withdrawn carries out with it a layer of slag along the shank. The thickness of this layer gives an indication of the viscosity of the slag, while its colour and surface texture is a guide to its composition. Chemical analysis of a number of samples which can be backed up by colour photographs of the samples will enable the steelmaker to estimate composition with reasonable accuracy and allow him to make such additions as are necessary.

Oxidizing Period

Oxygen is supplied to the bath either by addition of iron ore or by the injection of gaseous oxygen. Both methods have their adherents; both are capable of producing good steel. Phosphorus is

removed at low temperature by an oxidized basic slag and most of the phosphorus removal should be accomplished before the carbon boil. Even where oxygen is to be used for carbon removal, a feed of ore helps phosphorus removal since it avoids the rapid temperature rise that follows oxygen injection. If ore is used for carbon oxidation, the weight to be added can be calculated when the carbon to be removed is known. In the case of oxygen injection, the work of the BSCRA on the control of oxygen injection in foundry steelmaking, and particularly in promoting the use of reliable oxygen-metering equipment, is very valuable and takes the guesswork out of this phase of steelmaking[5].

Having checked temperature and carbon content, the bath weight being known, the volume of injection oxygen needed to reduce carbon to the required value can be read off the appropriate chart. In most cases, the furnace can be slagged off without waiting for further sample results. Removal of hydrogen during the boil is a physical process depending upon the sweeping out of gaseous hydrogen by large volumes of carbon monoxide generated by oxidation of carbon. A fast boil, removing 0.20 per cent. carbon using ore or an oxygen blow removing the same percentage of carbon, is sufficient to reduce hydrogen to an acceptable figure.

Reducing Period

The reducing period begins with the removal of the oxidizing slag and initial deoxidation, or blocking, of the heat with ferro-silicon and ferro-manganese. The reducing slag is put on the bath and fused, and is deoxidized by additions of carbon. Four things remain to be done:—(*i*) To deoxidize the bath thoroughly; (*ii*) to reduce sulphur to an acceptable level; (*iii*) to make up the composition to the required values; and (*iv*) to build up the temperature to the correct level. Economy aside, since the hydrogen content builds up from the time of slag off, all four functions should be completed simultaneously and as quickly as possible. At one time it was considered that the white slag itself acted as a reducing medium at the slag/metal interface and deoxidized the bath by diffusion, requiring time for completion. The more general conception nowadays is of the white slag protecting the bath from re-oxidation, and collecting (and in some cases re-reducing), the metallic-oxide products of the solid deoxidizers introduced into the bath. Certainly, it is not considered necessary to allow a minimum time under the white slag for deoxidation purposes. Sulphur removal does, however, take place at the slag/metal interface by direct reaction, but with a highly-basic fluid slag and repeated and thorough rabbling this is fairly quick. There remain adjustment of composition and temperature and, in practice, completion of these two functions usually controls the time taken for the reducing period.

British Standards and other steel castings specifications have wide composition limits. While this is often appreciated, the wide limits, for a number of reasons, should be narrowed considerably for melting-plant purposes. It is almost as easy for the steelmaker to work to a narrow as to a wide limit and in case of just missing the narrow limit, the heat will still satisfy the specification. Further, and this particularly applies to alloy steels to be subsequently hardened and tempered, narrow composition limits enable castings from different heats to be heat-treated together and to respond similarly to heat-treatment. Again, where foundry scrap may be used in induction furnaces, the tighter the control on analysis, the better chance the steelmaker will have in making induction-furnace charges correct in analysis. Finally, by keeping expensive alloy-elements to the low end of the specification, a considerable saving in metal cost can be made. For example, where a molybdenum range is given as 0.40 to 0.60 per cent., there is a difference of over £2 10s. per ton of liquid steel between the high and the low ends of the range, approximately the cost of electric power for making a ton of steel.

Examples of typical ranges of casting analyses specifications, compared with their equivalent British Standards, are given in Table 1. The bath temperature will generally be rising throughout the reducing period and with care, power input can be so adjusted that the bath will accept ferro-alloy additions without delay. From experience of a particular furnace, knowing the bath weight, the stage of life of walls and roof (*i.e.*, thickness) the operator can estimate the power input required

TABLE 1.—*Examples of Typical Melting Specifications, Compared with Equivalent British Standards.*

B.S. 592 Gr. A	C	Si	S	P	Mn			
Specification	0.25 max.	0.60 max.	0.060 max.	0.060 max.	1.00 max.			
Range of casting analyses	0.20–0.25	0.25–0.40	0.030 max.	0.030 max.	0.65–0.85			
B.S. 1456 Gr. B	**C**	**Si**	**S**	**P**	**Mn**			
Specification	0.25–0.33	0.50 Max.	0.050 max.	0.050 max.	1.2–1.7			
Range of casting analyses	0.28–0.32	0.25–0.40	0.030 max.	0.030 max.	1.30–1.50			
B.S. 1504 : 622	**C**	**Si**	**S**	**P**	**Mn**	**Ni**	**Cr**	**Mo**
Specification	0.18 max.	0.60 max.	0.050 max.	0.050 max.	0.40–0.70	0.40 max.	2.00–2.75	0.90–1.20
Range of casting analyses	0.10–0.15	0.25–0.40	0.030 max.	0.030 max.	0.50–0.65	0.40 max.	2.10–2.04	0.95–1.05

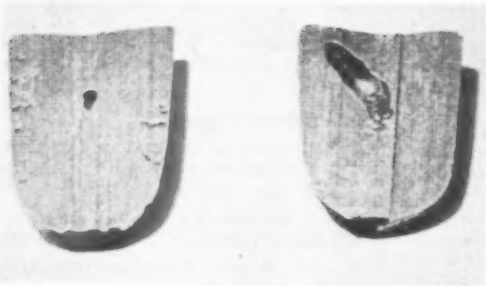

FIG. 2.—*Greensand samples: left, showing incomplete deoxidation and right, deoxidized testpiece.*

to produce the desired rate of increase in temperature, taking into account the effect of cold additions to the furnace. It is possible to calculate the power input required and prepare a series of charts showing the settings for any given set of conditions, but it is probably not worth doing because of the number of variables involved. A final pyrometer check will confirm that the steel is at the correct tapping temperature.

The steelmaker still requires to satisfy himself that deoxidation has been satisfactory and the steel

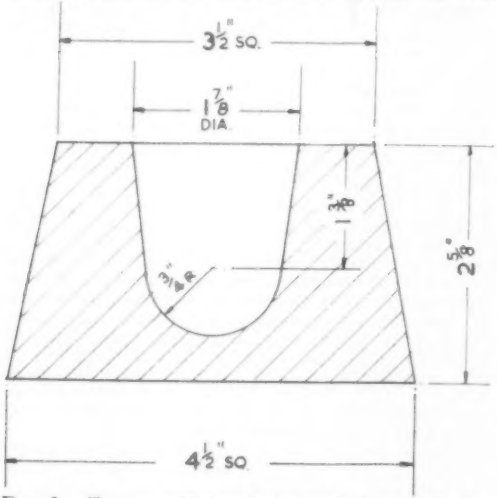

FIG. 3.—*Test mould (made in sand) for producing the type of samples shown in Fig. 2.*

will, in fact, make good castings. A sample drawn from the furnace and poured, without aluminium addition, into an iron sample-pot should show a pronounced shrink in the top surface. A more telling test is to pour into a *freshly made* greensand mould a similar sample, taking care that no slag is poured from the spoon: a slag spot on the top surface of the sample causes a local shrinkage and destroys its value. Such a greensand sample should show no signs of pinholes on the outside surfaces and, if sawn through vertically, should reveal a single shrinkage cavity near its centre, not a number of elongated holes distributed about the section (Fig. 2). The dimensions of the greensand mould are shown in Fig. 3.

From time to time, fluidity tests of the spiral and other types have been described. These require great care in setting up the mould and while they may be valuable where long runs of a particular casting are being made, their usefulness in the average steel foundry is doubtful. Immersion pyrometry has to some extent replaced fluidity tests and it seems likely that often, in the past, fluidity tests were checks on temperature, rather than of fluidity itself.

Temperature, composition, and conditions correct, the furnace can be tapped, the steel requiring only a final deoxidant in the ladle. The purpose of this final deoxidant is solely to protect the steel against atmospheric oxidation between taphole and mould, and against mould-moisture reactions: it must not be expected to do more. Aluminium is the commonest and most powerful deoxidant, but others have special properties, alone or in association with each other, such as modification of the type of non-metallic inclusions in the steel. No deoxidant or combination of deoxidants, however, can be a substitute for good steelmaking practice.

The approach to technical control of acid electric-arc steelmaking is broadly similar to that for basic arc, having regard to the differences in slag composition and the absence of the reducing period. If anything, timing is even more important for the acid process since its whole operation is quicker than the basic.

Induction-furnace melting makes its greatest demands on technical supervision up to the time the charge reaches the furnace stage. Thereafter, melting is progressive and its efficiency depends much on the skill of the melter. Apart from small oxidation losses of carbon, silicon, manganese, etc., there are no changes in the composition of the charge during melting. There is no boil, hence no removal of hydrogen, and after repeated remelting of scrap in such a furnace, the hydrogen concentration tends to build up and may reach a dangerous level. Where there are both arc and induction furnaces in a foundry, arc-furnace scrap can be remelted in the induction furnace and *vice versa*, and the hydrogen level in the induction furnace steel thus kept down to a safe level.

The charge is melted, the composition adjusted, and the bath deoxidized under a thin layer of slag, which, whether acid or basic in composition, takes little part in the process, except for protecting the steel from atmospheric oxidation. Temperature control is relatively easy; the rapid circulation of the bath makes rabbling unnecessary and the easy access to the surface of the metal allows immersion temperature readings to be taken, using a light thermocouple. Some special (usually high-alloy), steels, made in induction furnaces, require particular melting techniques, and, having estab-

lished the practice to be followed, control should be such as to ensure that it always is followed. This is a question of direct supervision of furnacemen.

Supervisory Staff

Technical control of steelmaking, combined as it must be with other functions, requires a man to be metallurgist, foundryman, labour controller, storekeeper and, often, buyer. His is the task of translating specifications and metallurgical theories into shovelfuls on the furnace stage. His duties can be summarized as follows:—(*a*) To control quality by supervision of operations and testing of materials; (*b*) to control labour so as to get maximum economy of manpower; (*c*) to control production rates in order to achieve maximum production and economy compatible with quality; (*d*) to record and report operating and material data to works management; (*e*) to record and report quantity data to the cost accountant, and (*f*) to carry out controlled experiments on new materials and techniques. With this range of functions, he is an important member of the works management.

Acknowledgment

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British Standards Institution

New British Standards listed in the January issue of *BSI News* includes Addendum 1:1960 to BS.2690 Methods of testing water used in industry. This provides methods for determining solids contents, carbon dioxide, dissolved silica, total iron and dissolved oxygen in high-purity water; price 6s. Another new standard is BS. 3292:1960 Direct reading hygrometers, which specifies two grades of non-recording direct reading hygrometers, both calibrated for use over the range 20 to 100 per cent. relative humidity. Permissible error, temperature correction, drift, response time and constructional requirements are specified and methods of tests described in appendices; price 12s. 6d.

Under the heading of revised standards are BS.466:1960 Electric overhead-travelling cranes for general use in factories, workshops and warehouses; BS.1251 Open fireplace componets, 1251 Part 4:1960 Lintels, price 4s.; BS. 1344 Vitreous-enamel finishes, group A, kitchen equipment: 1344 Part A1:1960 Resistance to thermal shock, 3s.; and 1344 Part A2:1960 Resistance to culinary acids, 3s. BS 1426:1948 Gas surface boxes has been reviewed and confirmed.

Amendment Slips

Amongst amendment slips issued are those to BS. 902:1941 Test code for fuel-fired melting furnaces used in the non-ferrous metals industry, amendment No. 1, and to BS.3802 Part 1:1959 Mechanical testing of steel at elevated temperatures. Determination of proof stress, amendment No. 1. When ordering the slips reference numbers PD 3989 and PD 3999 respectively should be quoted. Standards reprinted include BS 406:1931 Apparatus for workshop testing of permanent magnets, 10s. and BS. 600:1935 Application of statistical methods to industrial standardization and quality control by E. S. Pearson, 25s.

It is also recorded in this issue that new work has been started on the temporary prevention of corrosion of metal surfaces (during transportation and storage) (revision of BS. 1133 packaging code, section 6), and a draft standard, AA(ISE)6103 Grey-iron castings (revision of BS. 1452) is being circulated for comment, copies cost 3s. 6d.

Those wishing to obtain copies of the publications should apply to the sales branch of the Institution at 2, Park Street, London, W.1.

CFA Supervisors Course

The Council of Ironfoundry Associations has announced a new series of short residential courses on moulding machines, mould materials and defects, each of one week's duration, to be held in different parts of the country. The number of participants at each course is to be limited to 18. Anyone may be accepted who is sponsored by a foundry company and whose background and present or projected duties fit the objectives of the course. It is, however, intended to select from among the applicants to any one course those who will form a homogeneous group, so that all participants may derive equal benefit. The programmes are arranged to start on a Monday after luncheon and to end on the following Friday afternoon. The fee, which includes accommodation and all meals, is 20 guineas.

The first course is to be divided into eight sessions, the first three of which will cover mould materials, including different types of sand available, clay and coal-dust additions, etc.; coremaking and core materials; modern moulding processes, and sand tests. Session four, dealing with plant, will cover sand preparation, types of mills and cleaning plant. The fifth will be devoted to moulding machines and their characteristics, the sixth to defects—sand inclusions, slag inclusions, blowholes, scabs and shrinkage. Scrap control will be dealt with in the seventh session and the final session will be a "brains trust." Details can be obtained from the Training Officer of the Council of Ironfoundry Associations, 14, Pall Mall, London, S.W.1.

Industrial Films

Amongst new releases announced by the Central Film Library, Government Building, Bromyard Avenue, Acton, London, W.3, is "Mechanization and Automation in the Foundry," a black and white film; running time 13 minutes. It shows mass-production of cylinder-liners in the Renault foundry, in France. In the foundry, centrifugal-casting machines on a turntable are served by several conveyor units, enabling all operations—preparation of the mould, mounting, pouring, shakeout, and extraction of the casting—to be performed in one mechanized cycle.

American Automobile-engine Trends

Engineers' Comments on Manufacturing Problems Related to Light-alloy Castings Adoption

Developments in American automobile-engine design and production, *vis à vis* castings production last year were reviewed by the JOURNAL'S US correspondent in an article printed in December. What follow are extracts from papers presented at the January Congress of the Society of Automotive Engineers in Detroit; they extend the story to include present, immediate-future and long-term plans, especially in regard to castings requirements. Naturally, these plans are of interest to automobile founders not only in the United Kingdom, but all over the world. In opposition to moves in favour of aluminium, the viewpoint has been expressed in some circles that had grey-iron founders been allowed the same design-latitude that is now being accorded to designers in light alloys, they could have put up a very much stronger case for the retention of traditional applications for iron castings in the motor industry. Indeed, there are signs that it may not be too late to reverse matters, and nodular iron is said to be gaining favour.

The American Society of Automotive Engineers held their international congress and exposition of automotive engineering in Detroit from January 9 to 13. The "highlight" of the programme was on the Thursday when six lectures were given dealing with new engines for US passenger cars and illustrating the trend in casting materials. What follow are extracts taken from the papers presented at the Congress, indicative of the position in the USA in relation to the use of aluminium for motor-car engines.

American Motors' Plans

Mr. J. F. Adamson, Mr. C. E. Burke, Mr. D. V. Potter and Mr. W. J. Zechel (of American Motors' Corporation) talked about their company's new die-cast aluminium engine. In the introduction to their paper, they stated that for a long time grey iron had maintained its position as the major casting material for engines not entirely because of its physical properties, but primarily because grey-iron castings were cheaper than castings made from any other material or by any other process. However, in the die-casting process, the higher metal price of aluminium (when used instead of grey iron) could be offset by designs which took advantage of the die-casting method. For many years, the maximum weight of aluminium pressure-die-castings had been 20 lb., but the authors went on to say that owing to the development of larger die-casting machines, pressure die-castings up to about 100-lb. in weight could now be produced. The authors believed that the faster cycle time of the pressure-die-casting process seemed to provide the ultimate in cost saving and this was particularly true if automatic handling of the castings at the casting machine could be provided, as this would further minimize the cycle time.

The authors then dealt with other considerations which favoured the die-casting process and listed these as being (1) Inherent accuracy of die-castings which permitted reduced casting tolerances, uniform walls and minimum stock removal for finishing; (2) elimination of many machine operations (oil-passages and bolt-holes, for example, could easily be cored in place); (3) faster machining speeds (due to the excellent cutting characteristics of aluminium alloys); cleaner castings (no sand cores, no core wires or loose sand), and (5) an estimated weight saving of 70 to 80 lb. In addition to the potential advantages offered by the pressure-die-casting process, engineering and manufacturing objectives had been developed by their company to include two major considerations affecting the basic design of the engine. These, the authors stated as being (*a*) the retention of the existing maximum overall length of the Rambler six-cylinder engine to permit ready installation in current models, and (*b*) the retention of as much production and service interchangeability as possible, consistent with performance and with manufacturing and technical requirements associated with die-cast aluminium. They added that their company proposed to continue production of the Rambler six-cylinder cast-iron engine.

"A" Engine

As a preliminary engineering step, the authors stated that their company decided to design and build a relatively large number of aluminium engines which could be machined on the existing cast-iron cylinder-block production line; this preliminary engine was designated the "A" design. Believing that a sand-cast aluminium-block would serve for evaluating some of the design and material factors, sand castings were first obtained and tested while the long-term die-casting equipment was being developed. For the sand castings, Silumin Gamma, a special aluminium alloy, was supplied by the Honsel-Werke foundry in Germany. This alloy was chosen because it closely resembled the ASTM 12A die-casting alloy proposed for the die-cast version. However, it was fully realized that the final "answer" to the aluminium-block

American Automobile-engine Trends

problems did require the production of actual die-castings for test purposes.

Doehler-Jarvis in 1951 had sucessfully developed a four-cylinder in-line cylinder-block, designed for pressure-die-casting, and in 1954, built the then world's largest die-casting machine, with a locking pressure of 2,000 tons. This machine was later used to cast a six-cylinder in-line block and provided an important stepping stone in the development of the pressure-die-casting technique. The machine injected 65 lb. of aluminium in less than a second at 8,000-lb. pressure with a locked time of 30 sec.

Conversion to Die-casting

The conversion from grey-iron sand-cast design to aluminium die-cast design presented many problems and these the authors listed as:—(1) The minimum use of undercuts requiring loose-pieces —because the loading and unloading of loose-pieces slows down the cycle time, thus making the castings more costly; (2) die cores must be designed to provide sufficient heat-flow, prevent burn-off and eliminate heavy sections—which could contribute to metal porosity; (3) a cylinder-liner was required to give proper wear qualities and this should become a part of the casting, in order to avoid the sealing problems associated with wet liners.

Next, the authors dealt with the production of the centrifugal cast-iron cylinder-liner, saying that this had proved to be ideal for incorporation in the pressure-die-casting as the molten aluminium under high pressure penetrated into fine crevices of the rough exterior surfaces of the liner, thus creating an excellent interlocking bond. Next, they dealt with water-jackets production. They reported that the quality of castings from the first die was very encouraging and a considerable number of "A" engines had been installed in vehicles and driven for a total of over 1,200,000 miles. In this way, valuable information was obtained for

"B" Engine

Passing on to the "B" engine, the authors said that this final design differed from that of the "A" engine in a number of points. For example, the "B" engine included a die-cast water-pump-housing which required only one machine operation for the impeller face and a bored hole for the pump bearing. The "B" cylinder-block weighed 67 lb. of which 14 lb. was accounted for by the iron cylinder-liners The comparable as-cast weight of the production cast-iron cylinder-block was 166 lb. As machined and with bearing caps, 70.9 lb. compared with 142 lb. The initial work had been carried out using aluminium main-bearing caps, but the expansion of aluminium being greater than that of the steel crankshaft resulted in the simple expedient of using a cast-iron main-bearing-cap of conventional design.

Other Important Considerations

Building an engine with major components of two metals—iron and aluminium—of dissimilar expansion coefficients was the next subject dealt with. The American Motors' engine combined an aluminium cylinder-block with a cast-iron cylinder-head, iron cylinder-sleeves, cast-iron main bearing caps and camshaft and steel crankshaft). The cast-iron cylinder-head, for example, had a change in overall length of 0.035 in. from 20 deg. F. below zero to 220 deg. F. while the aluminium cylinder-block had a change of 0.065 in. in this same range. The approach of the authors' company to this problem had been to build the engine, run it under all conceivable conditions and analyse the results. Tests were started at extremes of operating temperatures in the form of bench tests. Partial engine-assemblies were studied in a freezer and in an oven. This was followed by tests of the car in a cold room; starts were made after overnight soaks at 20 deg. F. below zero, followed by running immediately out of the cold room to top speed on the test track and this procedure was repeated many times; the final design successfully passed all tests.

At the same time, the necessity of a corrosion study for an engine with an aluminium cylinder-block and a cast-iron head was recognized and much work was carried out on this problem, the result being that the feasibility of a die-cast aluminium cylinder-block was proved and an engine assembly that was now ready for the public.

Chrysler Developments

The next technical contribution to the Congress was presented by Mr. E. G. Moeller, Mr. W. L. Weertman and Mr. H. E. Eriksen of the Chrysler Corporation, the subject being their company's die-cast aluminium "slant-six" engine. After first dealing with the design background of the engine and other details, the authors dealt fully with cylinder-block assembly, first giving reasons similar to those of the previous authors for the use of the die-casting process and adoption of cast-iron cast-in liners. Wall sections, they stated, could be tailored to meet the strength requirements based on a fatigue strength of 10,000 lb. per sq. in. The authors then followed with details of the design of the cylinder, giving details of the water jacket, water-pump housing and main-bearing caps (which latter were also made of cast-iron). When the aluminium was cast around the iron cylinder-liners, residual stresses were set up in the aluminium due to the differential contraction of the two metals. To reduce this to the acceptable range of 10,000 lb. per sq. in., it was desirable to preheat the liners to approximately 315 deg. C. prior to making the die-casting.

After having dealt with the cylinder-head (which was of a chromium-alloy cast-iron), valve-gear, crankshaft, lubrication system, etc., the subject next covered by the paper was the cooling system. Here, the authors explained that the water-pump body was also an aluminium die-casting. The water capacity of the aluminium engine was 6½ quarts, as compared with 8 quarts of the previous cast-iron engine. As a result, engine warm-up time was reduced by about 10 per cent.—important in reducing the time for heater operation to become effective

and in reducing engine-wear associated with short trips.

Passing on to the subject of corrosion, the paper stated that urban waters containing in excess of 100 ppm. of chlorides, if not properly inhibited might cause pitting and intergranular corrosion of aluminium, but this could also be said when cast iron and brass were used.

Casting Considerations

The final section of the paper dealt with casting considerations of the die-cast cylinder-block. First, the authors described the design and said the die assembly weighed approximately 44,000 lb. and measured 83 in. wide, 60 in. high and 49 in. thick. A special 2,000-ton die-casting machine was designed to provide a locking force to withstand a metal pressure of 8,000 lb. per sq. in. Inasmuch as an engine cylinder-block was a highly-stressed part, good metal-quality was essential particularly as regards porosity and "cold shuts" which were common problems in aluminium castings. This had involved development of the proper metal casting temperature, die-temperature, gating, and other techniques. One of the most difficult dimensional tolerances to maintain was that of keeping cylinder-bore centres within ± 0.015 in. of their specified locations. To provide good castability, it was decided to use SAE No. 303 aluminium pressure-die-casting alloy containing 3 to 4.5 per cent. copper and 10.5 to 12 per cent. silicon.

Machining Considerations

Passing on to machining considerations, the authors said that as compared to cast iron, the lower hardness and higher machinability of aluminium permitted a reduction in cutting time of approximately 50 per cent. Finally, the paper enumerated a number of lesser advantages gained with die-cast aluminium parts, such as:—The cleanliness of die-cast aluminium as compared to iron castings; problems of incomplete shakeout of sand, core breakdown and burnt-in sand were non-existent; the flushing out of machining chips was considerably less difficult with aluminium especially with the open-deck block design, and due to the reduced weight, material handling benefits were obtained.

Buick Plans

"The New Buick Aluminium Engine" was the subject of a further contribution, the authors being Mr. J. D. Turlay, Mr. E. H. Holtzkemper and Mr. C. G. Studaker. An aluminium high-performance V-8 engine had been designed and built at Buick to power the XP-300 and LeSabre experimental cars of the early 1950's, but the new "Special" engine was the first mass-produced aluminium V-8 engine to be used in an American-built passenger car. A gradual evolution had been taking place at Buick since the introduction of the present line of cast-iron V-8 engines in 1953. Pump cover, water outlet and timing-chain cover had now been evaluated as aluminium pressure-die-castings and released for production—the water outlet in 1955, the water-pump cover in 1957 and the timing-chain cover in 1958. In addition, the authors stated that the 1961 large Buick engines included die-cast rocker arms, water-pump impeller, dynamo end-frames, generator bracket, fan spacer, fuel-pump dome and body. Experience gained through the use of such parts had given the company the necessary background to embark on a programme of extending the use of aluminium to the cylinder-block, cylinder-heads and intake manifold.

Dealing with corrosion, the authors said that their experience with the water-pump cover, timing-chain cover and water outlet had shown that with proper care in the selection of the alloy used, in meeting the design requirements, and in careful manufacturing control, corrosion did not become a field problem. All of these parts were now cast of GM-4097M alloy containing 11.0 to 13.0 per cent. silicon and less than 1 per cent. copper.

The aluminium cylinder-block and -heads were made by the semi-permanent-mould process*—due to the necessity for having sand water-jacket and port cores—and the intake manifold was made as a sand casting. Pressure-die-castings now included such components as the timing-chain cover, water-pump cover, water-pump impeller, water outlet, flywheel housing, oil-pump cover, rocker arms, rocker-arm shaft brackets, distributor body, starter and generator end-frames, carburettor-throttle body and oil-pressure indicator switch housing. The pistons, as in most automobile engines in use today, continued as gravity-die-castings. In the cylinder-block, conventional sand cores were used to form the water-jackets and lower-crankcase areas, while all remaining exterior surfaces of the castings were formed by metal die sections, resulting in an attractive casting appearance and providing excellent physical properties for such critical areas as the cylinder-head gasket surfaces. The problem of providing a satisfactory cylinder-bore surface economically had been overcome by this firm also in the adoption of cast-in-place iron liners, on the outside diameter of these centrifugally-cast sleeves were machined circumferential grooves of pitch eight per inch and depth 0.010 in., which effectively keyed them in the die-casting.

Elimination of Core Sub-assemblies

Cast-iron main bearing caps were being used with the aluminium cylinder-block, as in the other engines described by the foregoing contributors. The cylinder-head was also a semi-permanent-mould aluminium casting, having dry-sand water-jacket and port cores. An interesting feature of the head was the use of a one-piece water-jacket core, eliminating a pasted-core sub-assembly and reducing the number of cores demanded from the coreshop. Valve-seat inserts of alloy cast iron were employed and assembled into the cylinder-head by a shrink-fit process and separate pressed-in-place alloy-cast-iron valve-guides were also used to complete the

* Understood to be gravity-die-casting with the use of expendable cores or mould sections, usually of bonded sand—EDITOR.

cylinder-head assembly. The crankshaft was a pearlitic malleable casting, having the counterweight periphery and cheeks cast to size (thus reducing casting weight and machining required) and the piston was a one-piece casting of aluminium alloy.

After discussing the fuel system, engine ventilation and accessory mountings, the authors listed the following conclusions which they felt to be important as a result of the experience gained during the development programme described: (1) A pronounced weight saving had been made through the extensive use of aluminium in the engine described with no loss in engine output or durability; (2) a quiet, durable yet responsive engine had been attained by careful design consideration; (3) normal care of the cooling system had been found to be entirely adequate in the control of corrosion, and (4) engineering problems connected with an aluminium engine for a passenger car had been satisfactorily overcome and the further extension of aluminium to future engines would be governed primarily, the authors said, by economic considerations.

Pontiac's Tempest Engine

The next contribution was a description of the four-cylinder Pontiac "Tempest" engine by Mr. J. P. Charles and Mr. M. R. McKellar. This, they said, was the culmination of a programme encompassing design and evaluation of several in-line and Vee engines of six and eight cylinders, in both aluminium and iron. At the outset, one half of the 8-cylinder V-389 had been installed in a standard Pontiac more as an engineering curiosity than as a serious venture, but it ran at 92 m.p.h., with a respectable performance, and gradually the company began to realize that the four-cylinder engine was an excellent and economical one. The development culminated in the introduction of the Tempest car on November 3, 1960, to the general public.

Since the new engine was the offspring of the Pontiac V-8, the cylinder-head assembly was completely interchangeable, as were the connecting rod and piston, and in all, out of 44 major parts or assemblies, 28 were identical. Turning to the cylinder-block, the authors stated that the simplified method of coring proved to be very adaptable to the casting of this item. A comparison of the 389 cu. in. V-8 crankcase cores and the four-cylinder cores showed that both types were essentially the same except for the elimination of the barrel cores on the one bank. For example, the core dryers used to support the four-cylinder cores during baking were the same as used for the V-389 cores. This use of common foundry equipment extended also into the handling of the cores prior to actual setting in the mould. Hence, either V-8 or four-cylinder cores could be set in common carrying-fixtures in the coreshop and transported by conveyor direct to the moulding line. This direct-fixture setting, without major sub-assembly (which normally required the pasting of cores together on large slab cores) had proved very satisfactory in the production of the engine. Its extension to the new engine resulted in only seven cores being required to produce the cylinder-block.

Casting Methods

As mentioned earlier, the authors said the cylinder-head of the new engine was identical with the Pontiac V-8 heads, but as part of a general weight-reduction programme for the 1961 models, the weight of each head had been reduced 10 lb. from its 1960 counterpart. This was accomplished primarily by eliminating unnecessary water-jacketing volume. In making the cylinder-head, three heads were cast in each mould, the authors explained. As was the case with the cylinder-block, no pasting was required and only four cores were necessary for each head.

Large slab setting-cores were eliminated and casting accuracy was promoted, due to the drastic reduction in the number of cores required.

The authors next dealt with the valve-gear, crankshaft and main bearings for the new engine and dwelt fairly fully on the piston and rings. For the Tempest engine, the latter comprised a top compression-ring which was heavily chromium-plated—although this was more costly, it ensured at least 50,000 miles of service before wearing through the chromium. The ring was made of high-strength, high-modulus alloy iron—a material which had proved helpful in reducing ring-groove wear and preventing ring breakage even at very high mileage.

Passing on to consider other parts of the engine, the authors said that the one-piece sand-cast aluminium water-pump housing and timing-chain cover were identical to those of the basic V-8 water system, and the exhaust manifold and the intake manifold were of cast iron. In their conclusions, the authors stated that the Tempest four-cylinder engine had met the objectives set forth and these included minimum piece and tooling cost, maximum integration with existing manufacturing facilities, and an innovation to stir the imagination of a car-conscious public.

Oldsmobile

Oldsmobile developments were covered in the paper presented by Mr. G. Burrell and Mr. F. Ball. The Oldsmobile F.-85 automobile they said was conceived and designed around a new all-aluminium V-8 engine, known as the "Rockette." For example, aluminium intake manifolds were used and the pistons were of aluminium alloy. The cylinder-block was cast of '356' aluminium, this being chosen because of its high strength, castability and corrosion resistance.

Dealing first with the cylinder-block in more detail, it was stated that this was cast by the semi-permanent-mould process by the central foundry division of General Motors. Here again, centrifugally-cast iron cylinder-liners were cast in place in the block. The metallurgical structure of these iron liners resulted in a harder iron than that present in an all-iron block, the result being that bore wear was kept to a minimum. An

excellent bond was obtained between the aluminium block and the liners, thus ensuring good heat-transfer and low distortion. The cylinder-heads were cast in the same '356' aluminium, sand cores being used for the water-jackets and ports and metal moulds for the remainder. The combustion chambers were used as-cast and were extremely accurate because of the metal mould used to form them; pressed-in iron valve-guides and valve-seat-inserts were employed to ensure the long life of these parts. Cylinder-heads were symmetrical and could therefore be used on the left or right side of the engine. Turning to the valve mechanism, the authors said that the camshaft was made of cast iron and flame-hardened to guarantee long life. Cast-iron rocker arms were used on the valve train and the crankshaft for the "Rockette" was cast from pearlitic malleable-iron. The front cover was a one-piece die-cast aluminium casting and the water-pump housing and impeller were both of die-cast aluminium, the distributor also having a die-cast aluminium body. The engine had a two-jet carburettor, the throttle body being of die-cast aluminium for improved heat-transfer from the intake manifold so as to reduce carburettor icing.

Studebaker Packard

The final paper dealing with new engines was about the new Lark V1 overhead-valve engine and was presented by Mr. E. M. Sabo and Mr. H. R. Johnson, Jnr., of the Studebaker-Packard Corporation. The objective was a six-cylinder engine which could be produced with a minimum expenditure for new "tooling," and this technical contribution endeavoured to show how the objective was met and some of the problems encountered. Dealing first with the cylinder-block, it was stated that this was a grey-iron casting weighing 150 lb. as delivered to the block line, and during machining, about 37 lb. was removed, leaving a finished weight of 113 lb.

The cylinder-head, too, was of grey iron and a potentially serious condition had occurred in the experimental casting of the pilot-run of these grey-iron components. The problem was that trapped gases were breaking the top and bottom jacket-cores and causing a "blow" at the centre of the top "deck" on the manifold side of the head. This problem had been solved by the addition of six cored vent-holes on the manifold side, between the port openings and just below the top deck. These openings were first closed with pipe plugs and later with $\frac{1}{16}$-in. dia. cup-shaped core plugs, and the authors stated that very clean castings were now being produced and the foundry scrap rate was at a minimum. (The weight of the cylinder-head casting was 74 lb. and 58 lb. when machined.)

Next, the authors dealt with the initial designs of the inlet and exhaust manifolds and camshaft and showed how the designs had been altered or modified for the 1961 styling, and in the final summary of the paper they stated that the new "Lark V1" overhead-valve engine described had in fact been created with a very low expenditure on new "tooling" without compromising durability, performance or economy.

American Letter

Furfural Binders

In the January, 1961, issue of *Modern Castings*, an account is given of the use of furfural binders at the Milwaukee Works of the International Harvester Company. The new corebinder consists of a urea-formaldehyde resin modified with furfuryl alcohol, which is produced by a patented process. This type of resin was first developed as a glue in the plywood industry and has been in use for about 10 years. The binder is mixed with sand and a mild acid which acts as a hardening catalyst. The presence of furfuryl alcohol in the resin makes possible the progressive curing of the resin, due to a mild exothermic reaction between the acid catalyst and the alcohol in the presence of heat. Some of the catalysts in use are phosphoric acid, ferric chloride and ammonium phosphate. The acid/binder reaction takes place slowly at room temperature, and the mix has a bench-life of four to five hours. It is stated that the material cost of the new "F" process—as it has been christened—is about one quarter of that for phenolic-resin-coated sand.

Conventional sand-mixing equipment is suitable for mixing the ingredients used in the "F" process, and since the uncured resin is water-soluble, the mixer can easily be cleaned for other uses. At International Harvester's Milwaukee Works, a washed and dried "four-screen" lake-sand with a 45 AFS grain-refineness number, 600 lb. of sand and 0.4 per cent. of catalyst solution are mixed together for 30 seconds. Next, 2 per cent. of the furfural binder is added and mixing continued for a further 3½ minutes. Blowing of "F" cores requires a different approach to that used for shell cores, as the mix used for the "F" process is sticky and sluggish. For this reason, it is difficult to introduce into a corebox by the usual rollover/blow technique used for shell cores—except for the simplest of shapes. Also, furfural-bonded sand will not drain out of a skin-hardened core to produce a hollow core, as in the shell process.

Due to the differential in material cost, small solid "F" cores will have the advantage over comparative hollow shell-cores. Where size and weight become a factor, larger cores can be made in halves, and by blowing each half through a contoured mandrel, a hollow core can be produced, with controlled wall-thickness and interior ribbing for strength where necessary.

Blowing Technique

The "blowability" of the "F" process mix closely resembles that of an oil-sand core-mix, and relatively high air-pressure (in the range of 50 to 100 lb. per sq. in.) is needed to produce a sound, dense core. With the higher blowing-pressures used, a larger volume of air must pass through the corebox, and more venting area has to be provided. A clearance of 0.015 in. around the injector pins gives some of this extra area and still more is provided through the provision of 0.005-in. slots at the parting lines, the rest being made up with orthodox slotted vents.

The "F" cores strip from the corebox with relative ease and only an occasional application of parting agent is required. The same type of parting agents used on shell coreboxes serves well in the furfural boxes. Hot coreboxes for the "F" process are generally made from a good grade of dense grey iron, some used at the Milwaukee Works are fully machined, others are cast-to-size in ceramic moulds, the method used being determined by the complexity of the core and the degree of precision required. Here, all furfural cores are blown through slots along the parting line,

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the thickness of the slots being from ⅛ to ¼-in. thick. Since the boxes are gas heated, the back of each box is contoured to give approximately uniform wall-thickness and thus a uniform temperature.

A new type of coreblower is being developed to handle "F" process sands, some shell coreblowers are being modified and some oil-sand blowers are being altered. Equipment manufacturers, on the other hand, are beginning to produce blowers specifically built for the material. Usually, the optimum temperature and cure time for a new corebox can be worked out at the same time as cores are being blown to check out the venting system, but in general, cure times run from 12 to 30 sec. However, the core does not need to be completely cured in the box; once the hardening reaction has penetrated deep enough to give the core sufficient strength for handling, it can be removed. Chemical hardening all the way through the cross-section is completed within a few minutes after the core has been removed from the corebox. Cores of heavy cross-section are usually blown on a mandrel or given another heating for a short period in an oven.

Advantages of Furfural Binders

The collapsibility of the "F" cores is better than oil-bonded cores, so that shakeout is easier and possibilities of hot-tears are reduced. The surface finish of castings produced from furfural cores is not as smooth as those from shell cores, but is comparable with that from oil-sand cores. The principal savings obtained through the use of the new material, in addition to those from coremaking, lies in the reduced cleaning of castings, and here the savings accrued by switching water-jacket cores from oil sand to furfural at the Milwaukee foundry have been found to be remarkable. For example, some of the larger water-jackets produced by the company required as many as 31 core-wires of three different diameters. These had to be cut to size, bent to shape, placed in the cores, and then removed by hand in the cleaning room. It is estimated that the elimination of these wires by using furfural cores will result in a reduction of 20 per cent. in cleaning costs on cylinder-heads. Further savings will be made in the coreshop by the elimination of dryers, as the core is hardened while in the box. In addition, staff at the International Harvester Company feel that the better dimensional control obtained will result in an improvement in quality and reliability of the ultimate product.

It should be emphasized that the "F" process is not a universal process—many cores are still better made in oil sand or in shell sand for reasons such as size, casting finish required, or low production-requirements. However, the process is adaptable to many types of cores and the use of the technique described will, it is felt, make it possible for foundries to provide a better casting at a lower product cost.

Enamels in Architecture

A *Bulletin* has been published entitled "Enamel in Architecture" by the *Instit de L'Email Vitrifie* (French Institution of Vitreous Enamellers), whose address is 15, Avenue Ledru-Rollin, Paris 12. Rather than a textbook the *Bulletin* is an anthology of the various papers published on the subject of vitreous enamelling in this field. It contains a great deal of information including drawings of various sections and fixing details.

Notes from Australia

There has recently been formed a committee to explore the possibility of the formation of an Australasian foundry technical institute to include those now operating in Victoria, New South Wales, Southern Australia and New Zealand. One of the objectives is to secure representation on the International Committee of Foundry Technical Associations.

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A movement is on foot to form an Australian Association of Patternmakers, and a meeting is to be held early in December to consider policy and to elect an executive council.

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The inaugural meeting of the Newcastle branch of the Institute of Australian Foundrymen has been held. Mr. N. L. Bush, chaired the meeting, which was devoted to the showing of foundry films. These included one made at the works of F. H. Lloyd & Company, Limited, showing making of castings in a mechanized iron foundry and a steel foundry; the other two films were about spun-pipe manufacture at Stanton Ironworks Company, Limited, and the use of CO_2 sand in making cores.

(Acknowledgement for these news items is made to the journal *Castings*.)

Mill-housing to be Salvaged

There is every hope that the two 144-ton steel castings made for Colvilles, Limited, strip mill at Ravenscraig, and now lying under 90 ft. of water in the Mersey Estuary, will be recovered in about two to three weeks time. As reported in the February 2 issue of the JOURNAL, they were part of the cargo of a coaster which was sunk in the river following a collision. If they could not be salvaged, their loss would represent a disastrous delay in building the new mill.

The castings, amongst the biggest and heaviest of their kind made in Britain, were cast for Colvilles at the steel foundry of English Steel Castings Corporation, Limited, and were machined at the Sheffield works of Davy-United Engineering Company, Limited. Judged too large to be consigned either by road or rail, they were being shipped to Scotland by the coaster vessel Lurcher. Final machining is due to be carried out at the Govan machine-shop of Harland & Wolff, Limited. The castings were not damaged in the collision and it is said that submersion for a few weeks will not harm them. Whilst, according to a Colville's spokesman, there will have to be a certain amount of reorganization, if the castings are delayed no more than a month, the job can still be on time.

Light Metals Congress in Austria

Further information received in connection with the Light Metals Congress, to be held in Loeben, Austria (reported in the JOURNAL, January 26), lists, in addition to papers already mentioned, "Precipitation Hardening Behaviour of an Al/Cu/Li Alloy," by K. Anderko and P. Wincierz (Germany), and "Recent Progress of Metal Physics as Applied in the Research of Light Alloys," by T. Federighi (Italy).

The Congress is being organized by the Loeben College of Mining Technology in conjunction with the Austrian Light Metal Industries Association. The fourth of its kind, it will take place from June 20 to 24. The town of Loeben is situated south of Vienna and can be reached from there by express train in about three hours. This will enable delegates at the 28th International Foundry Congress (Vienna, June 18 to 24) to attend also some of the meetings.

Notes from the Branches

Bristol

The open meeting for discussion of topics of general interest to founders, held by the Bristol branch of the Institute of British Foundrymen in December, proved an exceptionally interesting evening. The first subject discussed was that of excessive burning back of a cupola lining. In the instance quoted, the lining was said to be frequently burning back to the extent of six inches during the course of a normal day's "blow" of six to seven hours. A significant feature in the operation of the cupolas was the practice of running with an open slag-hole and maintaining full blast-pressure until the last few minutes prior to the final emptying of the well. Members questioned the wisdom of this procedure, and generally favoured a reduction in blast-pressure and volume in the later stages of a blow. One member favoured shutting the slag hole in the final blow-down period. Other suggestions made were the flaring of tuyeres to give a reduced velocity of air, greater attention to the drying out of the cupola before use, and the use of the Rootes-type blower in preference to a fan.

Scabbing was another subject discussed. Some members expressed the view that possibly too much emphasis has in the past been laid on thermal characteristics of the mould material, since it was possible that gas pressure within the mould might be a factor which could contribute to the defect. Careful control of the sand type with deliberate introduction of mixed grain-sizes was also advocated; it was emphasized that this could prove satisfactory so long as permeability values were not seriously affected. The fact that dried moulds were usually less prone to scabbing was attributed to the reduced amount of gas-evolution from such moulds. One member raised the question of scabs appearing on the bottom face of a mould, and asked why the classical definition of a scab invariably illustrated the defect as taking place in the top part of moulds only. Another member suggested that the reason for scabbing occurring less frequently in oil-sand moulds was due to the greater permeability shown by these moulds.

Rod feeding was discussed at some length and members were divided in their views as to its purpose. Some contended that feeding was obtained by ensuring that the feeder head remained open and subject to atmospheric pressure, whilst others claimed some benefit was to be gained from the "pumping action" employed in rod feeding. One member felt that use of a Connor runner could frequently replace rod feeding and pointed out that the latter was primarily a feeding aid and not a runner as its name would seem to imply.

Metal/mould reaction with phosphor-bronze castings was a subject which promoted much discussion. Most of the existing theories were considered and one member claimed that considerable benefit could be obtained by the use of heated cores. This, he said, would prevent moisture absorption of cores while standing; also it was advantageous to heat the cores up to 60 deg. C. before use. The same conditions would apply to the use of CO_2 moulds; experiments had shown that CO_2 moulds and cores lost gas far more rapidly than greensand moulds.

Aluminium-alloy Castings

On Friday, January 13, an interesting evening was

The photograph shows some of the leading personalities at the annual dinner of the Sheffield branch of the Institute of British Foundrymen, held at the Royal Victoria Hotel. From left to right are Mr. W. F. Cartwright (president, Iron & Steel Institute); Admiral Sir Michael M. Denny (chairman, Cammell Laird & Company); Mr. G. R. Shotton (president, IBF); Mr. J. H. Pearce (president, Sheffield branch, IBF); the Lord Mayor, Ald. H. Slack; Mr. C. H. T. Williams, the Master Cutler, and Mr. R. S. Bruce (president Sheffield Chamber of Commerce). Details of the function were published in the January 26 issue of the JOURNAL. Photo by courtesy: *Sheffield Telegraph & Star*

Notes from the Branches—Bristol

held when Mr. T. Williams presented a paper on the production of aluminium-alloy castings. A large audience was well rewarded for attending the lecture, and many questions were put to Mr. Williams at the close of the paper. Replying to questions, Mr. Williams explained that by using chills on large, flat surfaces in mosaic or honeycomb fashion, the tendency to the formation of line porosity in the castings was largely eliminated. One factor of great value in minimizing troubles due to oxide-formation and its entrapment was the use of a carefully controlled pouring rate in association with the use of steel-wool plugs in the downgates. Tapered sprues also helped to minimize trouble arising from oxidized metal. In light-alloy founding, rounded feeder-heads were preferred to any other shape.

Asked about degassing techniques, Mr. Williams expressed preference for a combined nitrogen and tablet-form degassing—dry nitrogen being used first, followed ten minutes later by the tablets. In some cases, he said, the use of a nucleant was favoured. The value of LM6 alloy for pressure-tight casting was questioned by one member, and Mr. Williams said that "modification" of this alloy was essential. He indicated that maximum benefit was obtained if the metal was allowed to stand for up to 20 min. after modification. He added that the use of exothermic compounds helped in feeding.

In proposing a vote of thanks, Mr. D. F. B. Tedds said that the paper had been an excellent one and showed that by the techniques outlined by Mr. Williams, aluminium was once again coming into its own as a material of construction in the engineering world. Modern techniques in the foundry permitted production of remarkable new alloys, but, warned Mr. Tedds, there was no room for complacency, progress must be maintained to ward off the ever-present challenge from plastics in so many fields.

POA Course at Oxford

The Purchasing Officers Association are again holding their Advanced Purchasing Course at Christ Church and Pembroke College, Oxford. This year it will take take place from April 10 to 14, and the course will include study groups on European trade; plastics, and the application of operations research techniques to purchasing and stores departments. Mr. F. Garner, joint managing director of Joseph Lucas, Limited, is to give an address on "The Buyer and Productivity," and other lectures will be by Mr. Alexander King, director of the office of scientific and technical personnel, OEEC, on "Scientific Developments and Economic Growth," and by Mr. Erhard Poincilit, head of OEEC trade division, on "Trading Policies and Trading Arrangements in Europe." The closing session will be devoted to a discussion on "The Selection and Training of Purchasing Personnel." Detailed programmes can be obtained from the Association at Wardrobe Court, 146A, Queen Victoria Street, London, E.C.4.

British Oxygen Company, Limited, Rotherham, made a retirement presentation last month to Mr. HARRY RYALLS, local service engineer at Brinsworth, who has retired after 46 years' service with the company. Mr. ERIC RADCLIFFE, who joined the company 16 years ago at Rotherham and who has recently been transferred from Brinsworth to the works at Consett, Co. Durham, as works superintendent, also received an award.

British and World Shipbuilding

Lloyd's Register Returns for December Quarter

Steamships and motorships of over 100 tons gross under construction in Great Britain and Northern Ireland at the end of December, according to Lloyd's Register Shipbuilding Returns, totalled 258 ships of 1,694,188 tons gross. This is 59,655 tons less than the previous quarter and is the lowest figure since June, 1946. The highest post-war figure was 2,345,408 tons at the end of 1957. The total comprises 90 ships of 630,797 tons fitting out afloat, and 168 of 1,063,391 tons still to be launched.

Commenced during the quarter were 53 ships of 257,223 tons; launched, 67 ships of 376,222 tons, and completed, 57 ships of 322,653 tons.

Vessels under construction included 49 steamships of 854,004 tons and 209 motorships of 840,184 tons. In other Commonwealth countries there were under construction five steamers of 69,899 tons and 38 motorships of 125,512 tons. Oil tankers building in Great Britain and Northern Ireland totalled 46 ships of 806,527 tons, which is 27,173 tons less than the June quarter. Total construction in the principal districts is shown in Table I.

TABLE I.—*Shipbuilding Construction in Hand in Principal Districts of Great Britain and Northern Ireland.*

District.	December 31, 1960.		September 30, 1960.		December 31, 1959.	
	No.	Gross tonnage.	No.	Gross tonnage.	No.	Gross tonnage.
Aberdeen ..	13	7,812	15	8,255	17	14,685
Barrow ..	2	51,500	3	92,500	2	92,500
Belfast	12	226,285	11	197,970	15	282,850
Bristol	3	4,016	2	1,930	3	4,544
Clyde:						
Glasgow ..	50	346,952	54	424,226	51	475,529
Greenock ..	17	108,054	19	134,488	22	164,519
Dundee	3	12,400	4	12,614	5	23,923
Hartlepool ..	2	19,600	2	22,250	3	31,690
Hull	38	14,476	33	12,938	37	14,564
Leith	5	27,610	6	42,220	9	42,334
Liverpool ..	6	71,830	7	92,540	11	123,547
Middlesbrough	10	183,120	8	146,010	9	137,172
Newcastle-upon-Tyne	35	385,161	33	331,440	31	369,634
Southampton ..	11	8,116	11	11,040	14	12,092
Sunderland ..	20	220,094	20	215,162	23	234,382

Sizes of steamships and motorships under construction at the end of December in Great Britain and Northern Ireland included the following:—100 to 500 tons, steam nil (motor 93); 500 to 1,000 tons, steam 1 (17); 1,000 to 2,000 tons, steam 11 (15); 2,000 to 4,000 tons, steam 2 (4); 4,000 to 6,000 tons, steam 2 (4); 6,000 to 8,000 tons, steam 1 (21); 8,000 to 10,000 tons, steam nil (22); 10,000 to 15,000 tons, steam 6 (26); 15,000 to 20,000 tons, steam 3 (6); 20,000 to 25,000 tons, steam 4 (1); 25,000 to 30,000 tons, steam 8 (nil); 30,000 and under 40,000 tons, steam 7 (nil); 40,000 tons and above, steam 4 (nil).

Apart from China, East Germany, and Russia (USSR), from which countries no returns are available, there are under construction in the world 1,398 steamships and motorships of 8,667,082 tons, of which 19.5 per cent. is being built in Great Britain and Northern Ireland. The present total is 144,334 tons less than last quarter.

Of the steamships and motorships under construction throughout the world at the end of December, 4,457,465 tons (51.4 per cent.) are to be classed with Lloyd's Register. Of this total 1,651,261 tons, representing 97.5 per cent. of the tonnage being built there, are at yards in Great Britain and Northern Ireland.

AI Trainees at Falkirk

During the past 10 years, 160 apprentices have been trained at Allied Ironfounders, Limited, Apprentice Training School at Falkirk. For two years (presuming a successful passage through a short initial probation period), apprentices work on the foundry floor at Falkirk Iron Company, Limited, one day in each week being reserved for study at Stirling County Council's Burnbank Foundry Trades Centre. At the end of the two-year period they are graded "A" or "B" apprentices. The "A's" receive a further year's craft training at the Allied subsidiary, M. Cockburn & Company, Limited, and in the last two years of their apprenticeship they are attached full-time to one of the factories as skilled moulders. The "B's" spend the three years in rather less skilled fields of foundry work. On completion of their apprenticeship, those who show special ability are considered for appointment to technical departments of the organization, such as the method-study department.

In January this year, five new apprentices, boys of 15 or 16 years of age selected from candidates from a wide area, joined Allied Ironfounders at Falkirk, where they will be under the control of Mr. John Conry, supervisor of the school.

Three of the new apprentices in Allied Ironfounders' Apprentice Training School at Falkirk: William Smith, of Linlithgow, finishing a mould, is watched by Hugh Gardiner, of Westquarter; Alan Gow, of Maddiston, and Harry Young, assistant supervisor.

Mr. Norman Erskine, general manager, McDowall Steven & Company, Limited, who exercises overall supervision of the apprentices, reports that no fewer than nine Allied apprentices have obtained the first-class final certificate of the City and Guilds of London Institute in foundry practice, and one also obtained the same honour in patternmaking. Although there is no binding contract for any of the apprentices to remain in Allied Founders' employ at the end of their indenture, the record, showing that a high proportion do, speaks for itself.

Malleable Iron Conference

A conference to promote discussion of some of the current problems and ideas in malleable-iron research, properties and applications has been arranged by the Department of Industrial Metallurgy of the University of Birmingham. It will take place from April 27 to 28, and programme details are as follow:—

The conference will commence at 2 p.m. on April 27 with a welcome to members by Professor E. C. Rollason (of the Department of Industrial Metallurgy). Two technical sessions will follow: the first at 2.10 p.m. under the chairmanship of Mr. I. C. Hughes, B.SC., M.SC. (of the British Cast Iron Research Association), will be devoted to two papers (1) "Kinetics of Malleablising," by Mr. J. Burke, B.SC., PH.D. (University of Liverpool), and (2) "Metallurgy of Graphite Formation," by Mr. B. Walker (University of Birmingham). After a break for tea, there will be a discussion on "Malleable-iron Metallurgy."

Technical sessions on the Friday will be under the chairmanship of Mr. H. G. Hall, F.I.M. (Castings, Limited). The first paper to be presented—at 9.30 a.m. —will be "Properties of Blackheart Malleable," by Mr. C. T. Moore, A.I.M. (BCIRA), and the second, "Pearlitic Malleable," by Mr. R. Opitz (from Germany). The rest of the morning will be devoted to discussion of the properties of malleable iron. Dr. V. Kondic, B.SC. PH.D. (Birmingham University), will chair the afternoon session when Mr. J. Roxburgh (Ley's Malleable Castings Company, Limited), will present a paper on "Malleable Foundry Control," which will be followed by discussion of control of production of malleable. The final session, from 4 to 5.30 p.m., will be taken up with a general discussion of the metallurgy, properties, and production methods for the material.

Applications to attend the conference should be made as soon as possible to the Chief Technician, Department of Industrial Metallurgy, The University, Edgbaston, Birmingham 15 (accompanied by a registration fee of 10s. 6d. per person).

Glasgow College Expansion

Plans for a £1,250,000 building programme for the Royal College of Science and Technology, Glasgow, have been approved by Glasgow Corporation. The plans include an eight-storey extension to the engineering department at the junction of Cathedral Street and Montrose Street, a seven-storey chemistry block fronting Cathedral Street and a three-storey chemical technological block fronting John Street.

The extensions cover the third phase of the College post-war building programme which has cost £2,500,000. When the extensions are completed in 1964-65 the Royal College will be the most concentrated university-type structure in Britain with the possible exception of King's College, London. The extensions will allow the College to accommodate 2,200 full-time students—an increase of 400 on the present number.

Anglo-US Aluminium Group Income Up by 70 Per Cent.

Increase of 70 per cent. in the combined income of the British Aluminium Company, Limited, and Reynolds-T.I. Aluminium, Limited, is reported for the year ended July 31, 1960, by Mr. R. S. Reynolds, Jnr., president of the Reynolds Metal Company, US.

Earnings, before taxes, were $11,900,000 for the two companies, compared with approximately $7,000,000 a year ago.

Book Review

Materialfluss in Giessereien, Part 3 (Materials Flow in the Foundry) (in German); edited by Dipl. Ing. Kurt Barein. Published by Giesserei Verlag G.m.b.H. Düsseldorf; price 10 DM. (about 17s. 6d.).

This book is a creditable third volume of a comprehensive work dealing with material movement in the foundry—the first volume dealt with the theoretical aspects and the second with a systematic review of methods of materials handling. The work, which was commissioned by *Wirtschaftsverband Giesserei Industrie* with financial support from *Wirtschaft Rationalisierungskuratorium der Deutchen Wirtschaft* (R.K.W.), reports the results of a critical and comparative survey of materials-handling and movement in 23 foundries—five malleable-iron foundries, 14 grey-iron foundries and four steel foundries.

The book is divided into 10 sections, the first two of which give a considerable amount of factual information concerning the foundries examined. The data are presented in tabulated form and allow comparisons to be made for a wide range of operating ratios, amongst which may be listed: Output per operator, output per unit of floor-space, floor space per operator, and percentage of workers engaged on material movement. The various types of handling equipment used in the foundries are also listed. In the following chapters, information relating to materials movement is examined in detail for each of the main sections of the foundry, namely: stockyard, melting, moulding, coremaking and fettling. Comparisons are developed in relation to the number of workers and handling procedure, from which the handling cost per ton of material is derived for various methods. The final chapter summarizes the results of the investigation and lists conclusions.

Surveys of this kind are always interesting, but unfortunately the tendency to condense a complex number of variables into a few concise figures seems to be universally irresistible. One is apt to forget that "situations alter cases". This remark in no way detracts from the value of the work, which has been very well carried out. The information the book contains should be of interest to any foundryman, but the reader would be wise not to apply the conclusions too liberally. For example, the author's conclusion that materials handling may account for 47 per cent. of the total labour cost in the foundry should not be interpreted as materials handling accounts for 47 per cent. of the total labour cost. As in the previous volumes, the line drawings are of excellent quality, but (again) their presentation could have been improved by clearer and more-detailed captions.

A. A. TIMMINS.

House Organs

Safety, No. 11. Published by the Accident Prevention Committee of the British Iron and Steel Federation, Steel House, Tothill Street, London, S.W.1.

The accident-frequency rate in the iron and steel industry, after several years of decline, started to rise again in 1960, and intensive steps are being taken to arrest this tendency. Previous statistics appeared to show that frequency rates in steel works employing the largest number of personnel (over 5,000) and the smallest (fewer than 100) had the best records: the establishments employing between 100 and 150 having the poorest showing, but between 1956 and 1959 seemed to indicate that size and safety go together. Further examination, however, revealed that at all times there are large and small works with very low frequency rates—a moral being that safety lies not in numbers but where enough people are safety-minded! The type of goggle recommended by the Foundry Goggles Joint Advisory Committee is brought to the attention of readers as being a worthwhile advance in matters of safety. Owners of large foundries will find it useful to examine the human rescue equipment described and illustrated on page 33 of the booklet.

Newsletter, December 1960. Issued by the Women's Advisory Council on Solid Fuel, 18, South Molton Street, London, W.1.

A letter printed in this issue refers to the comparative cost of solid fuel, oil, gas, and electricity. It states that for Iveagh House, containing 161 flats, the cost of providing central heating and constant hot water by coke-fired boilers was £10 10s. per annum (or 4s. per week). In another article it is stated that those miners who live in smokeless zones are to receive £42 7s. per annum each in lieu of concessionary coal! A report is also given in this issue of a visit of the Minister of Power, the Rt. Hon. Richard Wood, to the Council's headquarters.

Foseco Foundry Practice, No. 144. Issued by Foundry Services, Limited, Drayton Manor, Tamworth, Staffs.

In this issue an interesting example is described and illustrated of a shrinkage defect occurring in an aluminium casting which had been made in a plaster mould. Two causes are assigned for the defect—one is inadequate feeding of the heavy section of the casting, and the other gas penetration. Recommendations are given for the production of this class of casting for master-patterns. In a second article, the production of pressure-tight valve castings is covered, and the issue is completed by notes on test-bar moulds and a mould-clamping device.

Compressed Air Comments, No. 4, 1960. Issued by Atlas Copco (Great Britain), Limited, Marylands Avenue, Hemel Hempstead, Herts.

The main article in this issue is about Mr. Enzo Ferrari, the designer and maker of sports cars bearing his name. It is well worth reading by car owners, especially those using the M1 and the like, because it indicates how data assembled in speed tests are related to production models. Other reports in the magazine deal mainly with the firm's products applied in various locations overseas.

Ruston Review and Paxman News, No. 6, 1960. Issued by Ruston & Hornsby, Limited, Lincoln.

This magazine it would appear is *inter alia* intended as a service to the firm's agents, because its pages tell of plant installations which the company has made all over the world. It is particularly well illustrated with ships and railway engines which have an irresistible appeal to a wide public. The whole presentation of the magazine carries the hallmark of a staff who are expert in the dissemination of news.

Cobalt No. 9. Published (Quarterly) by the Centre d'Information du Cobalt, 35, rue des Colonies, Brussels, 1, Belgium.

Printed in English, this magazine carries half-a-dozen articles, the most important of which is one on the use of the metal in permanent magnets and generators.

Industrial Rating

Industry, and in particular, the steel industry, is not allowing the proposals under the Rating and Valuation Bill to go unchallenged. The letter in *The Times* from Mr. C. W. Wheeler, president of the British Iron and Steel Federation, which was referred to in our issue of February 2, has sparked off a vigorous correspondence. Mr. David J. Young, financial director and secretary of the Steel Company of Wales, Limited, challenges the contention that industry's share of the total rate burden is unlikely to increase under the legislation proposed and that the steel industry's expectation of increased costs "has no validity."

Mr. Young maintains that the most careful estimates of the position suggest that the industry's relative share of the rate burden will increase to some extent. Another factor to be considered is the possible extent of domestic derating and Mr. Young does not think the Minister will fail to make substantial use of the powers to relieve domestic properties which are proposed in the Bill.

If as little as 25 per cent. domestic derating relief is granted, it is estimated that the steel industry's share of the effective national rating valuation could rise by about three quarters—from 0.9 per cent. to 1.6 per cent., he says.

Rate Cost per ton of Steel

Following from this, the rate cost per ton of steel would rise correspondingly, from about 8s. a ton to about 14s. a ton, even if total rate-borne expenditure did not increase in 1963-64. If domestic derating were put higher than 25 per cent. on average, the increase in the rate cost per ton of steel would be even steeper.

The assurance that the tools of production were free from rating was impossible to accept, he continues. "The steel industry is assessed, among other plant, on coke-making, iron-making, and steel-making plant. This position has always been most inequitable; and the industrial derating which counters its impact ought not to be withdrawn without corresponding action to remove or reduce the inequity itself."

Mr. E. R. Mayer, president of the National Union of Manufacturers, deprecates the absence in the Bill of any powers for reducing industrial rating as have been provided for domestic derating and emphasizes that the political aspect of increased residential rates should not be allowed to obscure the possible need for helping industry to reduce costs in order to survive in the competitive export market.

Industry's apprehension of the effects of the Bill, especially where fixed plant represents a large part of the rating valuations is referred to by Mr. C. E. Harrison, deputy president of the Federation of British Industries. He contends that the justice apparently produced by the full valuation of all hereditaments, "always of the roughest kind," became quite spurious when the value of fixed plant reached a sizable proportion of the total valuation of industrial properties. "Some derating of industry always was necessary in order to produce equality—not to depart from it," Mr. Harrison says.

A Scottish FBI spokesman deprecated any minimizing of the effect the valuation changes would have on the country's competitive ability. The increased rate burden on industry would be reflected in the price of raw materials, machinery, and components "all along the line," he declared.

In the new rateable valuation in the reassessment of all properties in Scotland, Harland & Wolff, Limited, Glasgow shipbuilders, has had its assessment raised from £10,840 to £30,000. The company's foundry, which is separate from the shipyard, has been re-assessed from £7,031 to £26,500. British Polar Engines, Limited, has had its assessment increased from £2,824 to £10,118, and the Saracen Foundry of Walter McFarlane & Company, Limited, has been re-assessed from £2,390 to £13,100. Thermotank, Limited, Govan, from £539 to £2,313, and the offices of Stewarts and Lloyds, Limited, from £183 15s. to £1,500. Similar percentage increases are reported from Midlothian.

Law Case

Guards Inadequate

At Keighley Borough Court a fine of £20 was imposed on Airedale Spring Manufacturers, Limited, Oxenhope, Keighley, for failing to securely fence dangerous machinery. The prosecution arose from an injury sustained by Mr. James Cone, who while operating a power press had put his fingers too near the tools of the press and had the tip of one finger severed. Miss K. M. M. Smith, the Keighley factory inspector, said that two guards were provided for the machine but both were inadequate. On the day of the accident one of the guards was fitted by the foreman but, later, it was removed, and it was then that the accident occurred. She said: "It is not clear who removed the guard or why, but the guard provided such little protection that it mattered little whether or not it was in postion." Mr. G. R. Beecroft, defending, said it was not a case of no guards being provided. The employers had considered that the guards provided were satisfactory; they had now fitted adequate fencing.

Radiography School

A brochure has been received from Kodak Limited, Wealdstone, Harrow, Middlesex, describing and illustrating operation of their school of industrial and engineering radiography, set up in 1943. It is stated that the need for training facilities is greater now than when the school was formed, for industrial radiography has become a recognized "tool" for non-destructive internal inspection of castings, assemblies and many other engineering products, and many industries need a constant supply of trained radiographers. Three courses are arranged at the school, the first, lasting four weeks, is officially recognized as the Lloyd's Approved Course in Casting and Weld Radiography; the Surveyors and Engineers' Course in Radiography lasts two weeks, and the Course in Gamma-Radiography lasts one week. By arrangement, courses to a special agreed syllabus can be arranged for employers or institutions willing to send groups of eight to 12 students to the school. Terms range from 15 to 30 guineas (not including accommodation).

British Trade Fair in Moscow

The British Trade Fair, sponsored jointly by the Association of British Chambers of Commerce and the All-Union Chamber of Commerce of the USSR, is to be held in the Sokolniki Park, Moscow, from May 19 to June 14. Exhibitors from the UK will include the Morgan Crucible group of companies, whose main exhibits will be Purox refractories, Crusilite heating elements, and Morganite and Morganohm resistors. The group will also be showing their crucibles, crucible furnaces, carbon electrical and engineering parts, etc. A complete range of portable pneumatic power tools will be shown by Desoutter Bros., Limited.

Personal

Mr. J. A. STEVEN has been appointed to the board of Bull's Metal & Marine, Limited.

Dr. W. D. SCOTT, managing director of BTR Industries, Limited, has been elected chairman of its subsidiary, Artrite Resins, Limited.

Chamberlain Industries, Limited, announce the appointment of Mr. DENNIS W. GRAY and Mr. RICHARD R. WATKINS to the board of directors.

Mr. R. H. BOISSIER has been appointed London area manager of Aiton & Company, Limited, in place of Mr. G. R. H. TROLLOPE, who has resigned.

Mr. ROBERT PALMER has succeeded the late Mr. ERIC FREER as general manager, foundries department, of Staveley Iron & Chemical Company, Limited.

Mr. K. GRANT, assistant general manager, and Mr. A. F. WAINWRIGHT, chief accountant, have been appointed to the board of Peter Brotherhood, Limited.

Mr. G. F. COLE, commercial director of Vono, Limited, Tipton (Staffs), has been elected to the Midland Regional Council of the Federation of British Industries.

Mr. JOHN S. LEIGH has been appointed assistant secretary of Brightside Engineering Holdings, Limited, and secretary of Brightside Foundry & Engineering Company, Limited.

Mr. F. D. DERRICK has been appointed managing director of the Matbro Machine Tool Company, Limited, Horley, Surrey, a subsidiary of the Matbro group of companies.

The Rt. Hon. the EARL OF COTTENHAM has retired from the board of Associated Automatic Machine Corporation, Limited, London, E.C.2, a subsidiary of Lockhart, Smith & Company, Limited, London, W.1.

Mr. W. A. BALLARD, general manager of the Belper (Derbyshire) works of Radiation Parkray, Limited, and Mr. A. S. PURDLE, general sales manager, have been appointed directors of the company. Radiation Parkray, Limited, recently formed subsidiary of Radiation, Limited, was formerly Park Foundry (Belper), Limited.

Mr. JOHN A. DRAKE, J.P., chairman and managing director of Drakes (Engineers), Limited, Halifax, received the C.B.E. from Her Majesty Queen Elizabeth, The Queen Mother, at Buckingham Palace last week. At the same ceremony, Miss JOSEPHINE BRENNER, secretary to the director of the British Cast Iron Research Association, received the M.B.E.

Miss L. VERITY, M.B.E., retired from the secretaryship of the National Association of Malleable Ironfounders on January 31 and also from the Walsall Chamber of Commerce with which she had been associated for 40 years. Her successor at NAMI is Mr. E. N. TURNER, who is also the new secretary of the Walsall Chamber of Commerce.

Bruce Peebles & Company, Limited, Edinburgh, report that Mr. SAM A. GASKELL, after 32 years service, is not to seek re-election at the next annual meeting. He has relinquished his post as chairman but will remain on the board. Mr. T. COUGHTRIE has been appointed chairman. Merger talks are taking place with the Belmos Company, Limited, of which Mr. Coughtrie is chairman.

Formerly for eight years secretary of Halifax and District Engineering Employers' Association, Mr. JOE LONGBOTTOM, secretary and director of Augusts, Limited, has been elected president of the Association in succession to Mr. G. M. BUTLER. Mr. H. L. MILLER, of Heywood, Helliwell, Limited, Brighouse, is the new vice-president, with Mr. FRANCIS D. DRAKE, of Drakes (Halifax), Limited, as second vice-president.

The Institute of Metals (Platinum) Medal has been awarded to Major C. J. P. BALL, chairman of Magnesium Elektron, Limited, in recognition of his outstanding services to the non-ferrous metal industries; in particular to the magnesium industry. Dr. P. B. HIRSCH of the Cavendish Laboratory, Cambridge, has been awarded the Rosenhain Medal for his outstanding contributions in the fields of physical metallurgy and metal physics.

Mr. ROBERT L. P. SALMOND, this year's winner of the IBF John Bell Scholarship, chose to use the award to make a tour of foundries in Norway and Sweden. The works he visited in Norway were those of Stavanger Electro-Staalverk, Jorpeland; Raufoss Ammunition Works, Raufoss; Strommen Voerksted, Strommen, and Bentse Stoperi, Oslo, and in Sweden he toured the foundry of Allmanna Svenska Elektriska Aktiebolaget (A.S.E.A.), Vasteras.

A director and company secretary of the Grimsby foundry firm of Harper, Phillips & Company, Limited, Coun. A. H. CHATTERIS has been elected an Alderman for the borough. He has been a town councillor for some time, serving on a number of committees. Past-president of the Lincolnshire branch of the Institute of British Foundrymen and a member of the Council of the Institute, Ald. Chatteris is also a member of the Institution of Engineers and Shipbuilders.

Mr. A. B. HUNT, whose seconding from F. H. Lloyd & Company, Limited, Wednesbury, to their Chittaranjan project was announced in the February 9 issue, points out that he had recently vacated the position of melting shop manager with APV Paramount, Limited, where he had been for the previous five and a half years. From the original paragraph, it appeared that his service with the Lloyd organisation had been continuous—apologies are expressed to all who may have been confused.

Dr. RENE VICTOR MARIE PERRIN, of Paris; Mr. CARL E. REISTLE, JR., of Houston, Texas, executive vice-president of Humble Oil & Refining Company and a former AIME president, and Dr. JOHN FAIRFIELD THOMPSON, of New York, honorary chairman of the International Nickel Company of Canada, Limited, and of its United States subsidiary, International Nickel Company, Inc., have been elected to honorary membership in the American Institute of Mining, Metallurgical, and Petroleum Engineers.

Technical director of Thomas Robinson & Sons, Limited, Railway Iron Works, Rochdale, Mr. JOHN H. DEX is retiring from the board of directors, but will continue his association with the company in an advisory capacity. Mr. Dex joined Robinson's as an apprentice in 1910, and was appointed foreman of the toolroom in 1920. In 1930 he was promoted to assistant works manager, and became works manager in 1938. He was appointed to the board in 1940 and became technical director in 1948.

Councillor JACK MORAN, of Rotherham, chairman of the Rotherham Joint Committee of the British Iron, Steel and Kindred Trades' Association, has been asked to accept nomination of the parliamentary panel of Rotherham steelmen. The Association represents 7,000 Rotherham and district steelworkers. This means that Councillor Moran will be a prospective successor to the present Member of Parliament, Mr. JACK JONES, who has intimated that he will not be standing again for Parliament at the end of his present term of office.

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MANUFACTURERS OF MANGANESE, SILICO-MANGANESE AND OTHER FERRO ALLOY BRIQUETTES

News in Brief

EMPLOYEES AT THE DONCASTER WORKS of the Ford Motor Company, Limited, returned to a four-day week on February 10 after being on a 15-day month since January.

BROADWELL ENGINEERING, LIMITED, mechanical handling engineers, etc., have recently moved to a new factory and offices at Dudley Road East, Tipton, Staffs, 'phones Broadwell 3102 and 1049.

Mr. K. WALKER, managing director, Laycock's Engineering, Limited, Millhouses, Sheffield, presented trophies at the annual dinner/dance of Laycock Engineering Cricket Club on February 11.

GRAHAMSTON IRON COMPANY, LIMITED, Falkirk, are to extend their inspection department at a cost of £2,800. M. Cockburn & Company, Limited, Gowanbank Ironworks, Falkirk, are to build a compressor house at their works, costing £950.

LEYLAND MOTORS, LIMITED, Lancs, have bought a 15¼-acre site next to Wellington House, their hostel which at present houses about 130 student engineers from different parts of the world. The site is expected eventually to house a new technical training college for student engineers of the company.

OVER TWO TONS of precision seamless and welded tubes in carbon, stainless and alloy steel, will be displayed on the stand of Tube Investments, Limited, at the Leipzig Spring Fair, opening March 5. A feature will be a tube weighing over a ton, with a 2-ft. dia., which will contain another finer than a human hair.

ENGLISH ELECTRIC COMPANY, LIMITED, are despatching two 6,000-h.p. electric motors to the West Driefontein and Doornfontein mines of Goldfields of South Africa, Limited. They are thought to be the largest converter-fed winders in the world, and the first to operate on a very high voltage system, a 40 kv grid.

TRAFFIC AT BRITISH TRANSPORT DOCKS rose last year by over 4,500,000 tons to nearly 50,000,000 tons—an increase of 10 per cent. compared with 1959. Imports, at 28,431,000 tons, were up by 16 per cent., whilst exports increased by three per cent., to 21,165,000 tons. The biggest increases were in iron-ore imports and petroleum exports.

A SPEARHEAD exported to Canada from Sheffield in the 1840's has now been returned to the city and will be displayed at the Sheffield City Museum. It was made by the now-extinct firm of Jukes Coulson & Company. Mr. David Bearspaw, a Canadian Red Indian, who sent the spearhead to Sheffield Museum has been sent a Sheffield-made hunting knife in exchange.

STOCKHOLDERS of the Staveley Coal & Iron Company, Limited, are being asked to agree to a change in the company's name to Staveley Industries. The chairman, Mr. John Hunt, says that the change would be more in keeping with the company's present activities, which now consist "almost entirely of shares in subsidiary companies operating in a variety of industries."

THE CONSTRUCTION of a new survey ship for the Royal Australian Navy is starting in an Australian shipyard this year, as the Navy's first vessel specially designed rather than converted for survey work. The new ship will be about 2,300 tons and have a helicopter, modern fixing instruments, small auxiliary boats fitted with echo sounders, and many other advanced survey features.

FREDERICK PARKER, LIMITED, of Leicester, have received export orders for asphalt-making plant for South Africa and Japan. The South African contract is worth £32,000 and is for use to produce the surface material for the new £3,000,000 open expressway through Port Elizabeth, Cape Province. The plant for Japan is to be used for a road between Nagoya and Kobi.

AS PART OF UNION CARBIDE'S sales campaign for ferro-alloy briquettes, Mr. W. B. Whitworth, the firm's sales manager, alloys division, will appear in A.B.C.'s industrial television programme "Industry to Industry" on Saturday next at 5.30 p.m. for Midlands and Northern viewers. Mr. Whitworth will discuss the product with the industrial correspondent of a northern newspaper.

AN ORDER from the Air Ministry for four 12,000-gall. per day sea-water evaporators, together with associated equipment, has been placed with Richardsons, Westgarth & Company, Limited, Wallsend, Northumberland. The evaporators will provide drinking water for Royal Air Force personnel at Sharjah in the Trucial Oman, and Masirah Island, off the coast of Muscat and Oman.

THE *Verein Deutscher Giessereifachleute*, the German Foundrymen's Technical Association, will hold a conference and exhibition, covering magnesium castings and their place in engineering, at Haus der Technik, 1(a) Hollestrasse, Essen, on March 23 and 24. Nine papers are to be read covering various aspects of the subject. Details are available from the VDG, 70, Sohnstrasse,, Düsseldorf 22a, Germany.

IN RESPONSE TO REQUESTS from members, the National Society of Master Patternmakers has arranged for Mr. Norman Shaw to repeat his lecture on "The Shaw Process" at a meeting to be held at the Engineering Centre, Stephenson Place, Birmingham, on March 1, commencing 2.30 p.m. At the meeting members will have the opportunity of obtaining information on such points as dimensional accuracy, surface finish, costs, etc.

PRIESTMAN BROS., LIMITED, the Hull engineering firm, has obtained an order worth £650,000 for 167 dragline excavators and ancillary equipment from the Polish Government. On delivery of this order the Polish Government will have a fleet of 300 Priestman excavators digging and maintaining drains and canals. The company has been making earth-moving machinery for nearly 80 years and exports regularly to more than 60 countries.

THE RESIDENTS OF PARKHILL FLATS at Sheffield may soon enjoy better rest at nights. They have complained of their inability to sleep at nights due to the noise from a nearby forge, but a test silencer is expected shortly which, it is hoped, will bring some relief. George Senior & Son, Limited, the owners of the forge, are to fit the silencer to the exhaust on one of the hammers as an experiment, and if successful, other hammers will be similarly treated.

UNITED STEEL COMPANIES, LIMITED, Sheffield, will hold their annual conference of works councils at Harrogate in March when human relations, pensions and long-service awards will be among the topics to be considered. Mr. A. J. Peech, deputy chairman and general managing director, will speak on the concern's current and future plans, and Mr. K. G. Lampson, managing director of the sales division, will discuss market problems.

BRITISH RAILWAYS' £9,000,000 MODERNIZATION PLAN for Sheffield has been approved and work will start in early summer. It is designed to make Sheffield the most up-to-date freight centre in the north of England. The scheme to cover three years' work, includes the

Electrical Aids in Industry *Data Sheet* **No. 16**

Speed control of Electric Motors

'Variable' speed may involve two or three (or more) speed steps or infinitely variable (stepless) speed control. It is this latter type which is considered below. Of the many advantages of electric drives, the opportunity offered for infinitely variable speed control is outstanding. Unfortunately this advantage is not used as much as it might be.

Principal Factors Affecting Choice of Drive

(a) First cost, (b) Efficiency, (c) Speed range, (d) Regulation, (e) Power-to-weight ratio, (f) Availability of supply, (g) Maintenance and reliability, (h) Change in power and torque over the speed range, (i) Simplicity of control gear, (j) Effect of variation in supply, (k) Power factor, (l) Characteristics of the load, (m) Operational environment, (n) Braking requirements.

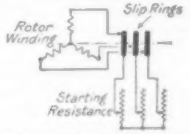
The following are some methods of obtaining infinitely variable speeds:

Alternating Current Motors

The vast majority of electric drives employ A.C. motors. Although not quite so flexible as D.C. motors, there are available many types which give a large measure of speed variation.

INDUCTION MOTORS. Although the squirrel-cage motor is essentially a constant-speed machine, it is much used for stepless variable-speed drives with one of the following types: (a) Eddy-current coupling, (b) Ferro-magnetic particle coupling, (c) Mechanical drives, e.g., belt drives and friction drives, (d) Hydraulic variable-speed drives.

SLIP-RING MOTORS. The slip-ring motor, which costs more than the squirrel-cage motor, can be varied in speed by



means of the resistors in the rotor circuit used for starting. The amount of resistance in circuit can be varied by hand, push-button or automatically controlled contactors.

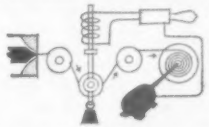
A.C. COMMUTATOR MOTORS. These are three-phase induction motors provided with additional windings which, through a commutator and brushes, permit speed adjustment in either direction below and above synchronous speed. The brush gear can be automatically controlled in such a way as to vary the speed in accordance with a known programme or cycle of operation.

Ward-Leonard System

In this system the armature of a D.C. motor is supplied at variable voltage from a separate generator. The generator may be driven by an A.C. or D.C. motor directly coupled to it and to an exciter which supplies the field windings of the generator and main motor. By means of a potentiometer resistance, the generator voltage may be varied from maximum to zero.

Electronic Motor Control

The speed of motors can be controlled accurately by electronic methods. Such drives can respond in any desired manner to variations, and several drives



can be interlocked so that their speeds are always in the same ratio. The system can be speeded up or slowed down from a 'master' controller, but for 'running in' purposes the speed of each drive can be individually regulated. Electronic speed control has been successfully applied where human control is not possible, e.g., in register control. In this example, print must always be placed at exact position on packaging material.

Direct Current Motors

The striking advantages of D.C. motors sometimes make it worth while installing a motor-generator set, a mercury-arc or semi-conductor rectifier. The speed of D.C. motors is easily controlled by inserting a resistance in series with the motor. Although this can result in a certain amount of wasted electricity, the benefits derived will often heavily outweigh such losses.

For further information get in touch with your Electricity Board or write direct to the Electrical Development Association, 2 Savoy Hill, London, W.C.2. Telephone: TEMple Bar 9434.

Excellent reference books on electricity and productivity (8/6 each, or 9/- post free) are available – 'Electric Motors and Controls' is an example.

E.D.A. also have available on free loan in the United Kingdom a series of films on the industrial uses of electricity. Ask for a catalogue.

7916/4

CUT HERE

News in Brief

closing of the nine existing goods yards and the concentration of the work on a great new £2,000,000 freight depot at Grimesthorpe. A marshalling yard and diesel depot is to be built at Tinsley at a cost of £7,000,000.

AUSTRALIA'S LARGEST MOTOR-CAR MANUFACTURERS, General Motors-Holden, Limited, are to dismiss 2,600 of their labour force of 16,000, because of a drastic decrease in sales. The retrenchments at G.M.H. follow substantial dismissals by other motor manufacturers in Australia, who claim that the dismissals are the direct result of the Federal Government's economic measures last year which increased sales tax on motor vehicles and restricted credit. Other industries allied to the motor industry are expected to be affected.

AT A CONFERENCE in Birmingham, eight small firms in the fancy brassware trade agreed to form a group operating in unison in the export field. Mr. J. G. Dericourt, head of Deverlea Products, Limited, is the main architect of the project. It was agreed that a showroom shall be acquired in Birmingham for display of the member-firms' products to overseas buyers; a joint catalogue is to be published, and the Board of Trade is being asked to co-operate by informing potential customers of the facilities available at the showroom.

AN ORDER for what is believed to be the largest installation in the world for the continuous casting of steel has been placed by Shelton Iron & Steel, Limited, of Stoke-on-Trent, with Distington Engineering Company, Limited, of Workington, a subsidiary of United Steel Companies, Limited. The plant, being built under licence from Concast A.G., of Zurich, associates of Distington in the field of continuous casting, will consist of four vertical continuous-casting machines with a total of 13 strands, equipped to cast billets in a large variety of sizes.

INDUSTRIAL PLANS for the East and West Ridings of Yorkshire put forward for approval last year were a record, the Regional Board for Industry has reported. It is said that corrected figures for industrial development certificates will probably show that they were granted 8,500,000 sq. ft. of space—1,200,000 sq. ft. more than in 1955, the previous best year. The Board of Trade report described 1960 as "outstandingly good" for the steel industry in which many firms set up new output records and also for certain branches of the engineering industry.

HULL CORPORATION have had a further five smoke-control orders confirmed by the Ministry of Housing and Local Government. This is the second stage in the programme of the City Council for making Hull as smokeless as possible by 1971 and it affects another 25,000 to 30,000 people. The orders are to come into force on October 1 this year. The five new areas contain 9,342 premises extending over 2,291 acres. A year ago, Hull had a bigger smokeless area than any town or city in the country outside London and it is believed the latest orders will keep Hull in front.

A NEW FACTORY for Hull Steel Radiators, Limited, at 1515, Hedon Road, Hull, has been opened by Mr. A. Lindholm, governing director of the Swedish parent radiator-manufacturing company—it is the first to be built by the firm abroad. The factory, which will produce the firm's pressed-steel radiators for closed-circuit hot-water central-heating systems, is equipped with modern automatic-welding machinery. A full range of wall-panel and column-type radiators will be manufactured and initially partly-processed radiator parts are being imported from Sweden for assembly; complete manufacture will eventually be done at Hull.

THE S. A. MONK COMPANY, makers of high-speed knitting machines, Sutton-in-Ashfield, Nottinghamshire, are considering acquisition of a new factory on the Continent to increase output and offset effects of the Common Market. The firm sends more than £1,000,000 worth of machinery and spares abroad annually. In recent weeks they have had to turn down orders worth more than £500,000. The firm was started in 1928 by S. A. Monk, senior, in Mansfield. They moved to Sutton in 1930 and started 10 men on precision machinery, chiefly fully-fashioned hose machines. The firm has taken a leading part in the increased productivity and modernization of British hosiery factories. A large staff now carries out the manufacture of fully-fashioned hosiery machines, accepted as the best of their type in the world.

Obituary

Mr. CLIFFORD HARRIS PRIVETT, former Sheffield area representative, Newton Chambers & Company, Limited, Chapeltown, has died at the age of 76. He retired in 1958.

The death has taken place of Mr. JEAN PARAVICINI, who until his retirement in 1958, was technical manager of the Britannia Iron & Steel Works, Limited, Britannia Iron Works, Bedford.

Mr. LAWRENCE WAITE, head of the wages department of the Staveley Iron and Chemical Company, Limited, Chesterfield, has died at the age of 58. He had been associated with the company for 40 years.

Mr. W. T. THOMPSON, who was manager of the ledger department of Thos. W. Ward, Limited, at the Albion Works, Sheffield, when he retired in 1946, has died at the age of 83. He served with the firm for 40 years.

A director of Oughtibridge Silica Firebrick Company, Limited, near Sheffield, Mr. T. RICKMAN LYNAM, has died, aged 53. He joined the company in 1935 as technical manager, and became a director and general manager of the Oughtibridge works in November, 1952.

The death has occurred at the age of 62 of Mr. JOSEPH VARLEY, who for more than 20 years was company secretary of Richard Firth & Sons, Limited, textile-machinery makers, Brook Mills, Cleckheaton. For the past three years he had lived in Keighley where he owned a grocery business.

Mr. WILLIAM WESTLEY, a director of Wm. Westley & Sons, Limited, brass and bronze founders, Dudley (Worcs), has died aged 78. He joined the family business, founded in 1800, at the age of 11. Mr. Wesley was a life member of the Staffordshire Iron and Steel Institute and a member of the Birmingham Exchange. For a number of years he was a member of Dudley Town Council.

The death has occurred of Mr. FRANK WEST, chairman of the Derbyshire Silica Firebrick Company, Limited, near Buxton. He had been with the company from its earliest days and had been chairman since 1922. He succeeded his father as managing director in 1919 and altogether had been with the company for 62 years. He was president of the British Ceramics Society 1925-26 and vice-president of the British Refractories Research Association in 1955. He was a member of the Joint Refractories Research Committee of the Institution of Gas Engineers and the BRRA, and had been an honorary Fellow of the Institute of Ceramics since 1955. He was chairman of the Society of British Gas Industries 1930-31 and had been chairman of the refractories section for several periods.

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(Hardness of aggregate 7·5 MOHS. Cuts glass)

ENORMOUSLY HIGH STRENGTH IN A MATTER OF HOURS
(For example 12,000 lb. per sq. inch at 24 hours and 16,000 lb. per sq. inch at 7 days)

HIGH DENSITY
(167 lb. per cu. ft. air-dried—20 lb. per cu. ft. higher than normal)

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(up to 1,150/1,200°C.)

OR ALL ABOVE PROPERTIES COMBINED

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AP91

Raw Material Markets

Iron and Steel

Pig-iron production is more than sufficient to meet the present demand of consumers. The steelworks continue to absorb the major portion of output in the form of basic pig-iron and are well provided with supplies both for consumption and stock. Difficulty is still experienced in obtaining the required quantities of furnace scrap, and a greater proportion of pig-iron is being used in mixtures. The foundry grades of pig-iron are also adequately available, and for most of these irons current output is in excess of consumers' requirements. Although the recession in the car industry is restricting consumption of low phosphorus irons, substantial tonnages of this grade are being utilized by engineering and speciality foundries, together with supplies of hematite and some refined irons. Producers of high-phosphorus irons have plentiful supplies from stock and current output to meet the needs of light, jobbing and textile foundries.

There is little change in trading conditions at the iron foundries, although some sections of the car industry are stepping up demand for castings. Many other industries continue to call for substantial tonnages of high duty castings, and the foundries supplying these are well occupied. Little change is found in the demand for light castings, the chief call being from the building trades. Only moderate demand is being made by the domestic utensil trade. The jobbing and textile foundries are moderately employed.

The supply of scrap to foundries, particularly in some areas, continues difficult, and arisings of suitable cast iron and steel scrap are insufficient to meet all demands made upon merchants. Foundry coke supplies are being received satisfactorily and ganister, limestone and firebricks are readily available.

Most re-rollers continue to obtain good outputs of small bars and light sections, although the pressure for supplies has lessened. Reinforcing rods and bars are maintained in heavy demand, but the call for hot rolled strip and bright steel bars is well below previous levels on account of the restricted requirements of the car industry. Plentiful supplies of mild steel billets are at the disposal of re-rollers. Apart from stocks they have on hand, home steelworks are able to supply larger quantities than those at present in demand. Carbon and alloy steel billets are not so plentiful. Arisings at steelworks of suitable defectives and crops are readily accepted by re-rollers.

Non-ferrous Metals

The African scene dominates non-ferrous metal markets and the copper quotation in London has moved up sharply. However, the market was supported more by professional operators covering bear positions than by actual demand, but the upward movement came to a halt and was then reversed on the announcement of the Copper Institute's figures for January. These showed that world production of copper had advanced 2,808 tons to 321,548 tons, although copper deliveries fell by 2,535 tons to 314,439 tons and global stocks were up to 436,889 tons, an increase of 9,107 tons since the end of December.

The New York copper market is a little better, but the price structure is unaltered at 29 cents a pound for both custom smelters and producers. The outlook should be fairly clear. Stocks of copper are more than adequate to meet demand so that the dislocations of supplies, for whatever reasons, would have to be prolonged before the weight of stocks overhanging the market would become manageable. The only point worth noting in this situation is that a great proportion of these stocks are held by producers so that if market demand improves it would quickly impinge on current production and, therefore, start an upward price movement which would not be met by drawing on stocks.

Tin in London has been a good, steady market on fears of an interruption to supplies because of the Congo troubles. Any obstacles to the supply position in this metal can be serious as stocks are low, production and consumption are fairly evenly balanced, and if there is any upsurge in demand the price will go quickly over £800 a ton. The US market is hesitant but, on the whole, steady and the price is fractionally over $1.01 a pound. The Singapore market has been quiet owing to the Chinese New Year but after this holiday period activity has been good and the price has moved ahead several points.

Lead in London is a reasonably good market on steady demand considerations, the improvement in zinc, and on the cutback in production by the St. Joseph Lead Company, which announced last week that it was cutting back production by 15 per cent. and deferring plans designed to expand its refinery throughput from 110,000 tons to 150,000 tons. Other US producers are expected to make similar announcements detailing reductions in output. Meanwhile, the market is steady in New York where the price is still called at 11 cents a pound for spot metal.

Zinc is an active market in London and steady in the US, where the price is holding at 11½ cents a pound. The price was supported by the announcement from the St. Joseph Lead Company which will mean a reduction in zinc output of 1,650 tons of zinc metal a month.

Further Australian Expansion by Metal Industries, Limited

Further extension of its Australian activities has been undertaken by the Metal Industries, Limited, group. It has acquired the whole of the share capital of Alcol Holdings Pty., Limited, electrical engineers, of Silverdale, near Sydney, NSW, which in turn owns the whole of the share capital of Alan Colless, Pty., Limited, and Designed Control & Manufacturing, Pty., Limited.

Alan Colless specializes in the sale throughout the continent of the products of Brookhirst Igranic, Limited, the major electrical engineering subsidiary of MI. Designed Control & Manufacturing manufactures control gear based on components made in England by Brookhirst Igranic.

Correction:

A footnote in the February 16 issue of the JOURNAL transposed the organizations with which the joint Authors of the article "Effect of Tin on the Mechanical properties of Pearlitic Nodular Iron" are connected. It should be made clear that Dr. Prytherch is attached to the Tin Research Institute, and Mr. Gilbert to the British Cast Iron Research Association. Apologies are offered to the Authors and to readers.

RUSTON & HORNSBY (AUSTRALIA) PTY., LIMITED—Mr. E. S. Everitt, managing director of Ruston-Bucyrus, Limited, and a director of Bucyrus-Erie Company, of the US, has joined the board.

BIG SHOTS

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BP/F12a

Current Prices of Iron, Steel, and Non-ferrous Metals

(Basis prices, delivered unless otherwise stated)

February 22, 1961

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2, 10-ton lots or over: Middlesbrough, £21 17s. 0d.; Birmingham, £21 9s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.40 per cent. P 10-ton lots or over, £23 5s. 0d., delivered Birmingham £23 10s. 0d., delivered Grangemouth.

Cylinder and Refined Irons.—North Zone, £25 6s. 6d.; South Zone, £25 9s. 0d.

Refined Malleable.—P, 0.10 per cent. max.; North Zone £26 6s. 6d.; South Zone, £26 9s. 0d.

Hematite.—Si less than 2 per cent, S. & P. over 0.03 to 0.05 per cent., 10-ton lots or over; N.-E. of England (local iron), £23 19s. 0d.; Scotland (Scotch iron), Zone S.1, £24 5s. 6d.; Sheffield, £25 9s. 0d.; Birmingham, £25 13s. 0d.; Wales (Welsh iron), £23 19s. 0d.

Basic Pig-Iron.—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leicestershire in 10-ton lots or over.

FERRO-ALLOYS

(per ton unless otherwise stated, delivered)

Ferro-Silicon (6-ton lots and over).—45 per cent. Si, £43 10s. 0d. to £46 0s. 0d., scale 15s. 0d. per unit, lumpy. 75 per cent. Si, £60 0s. 0d. to £63 10s. 0d., scale 15s. 0d. per unit, lumpy.

Ferro-vanadium.—50/60 per cent., 22s. 6d. per lb. of V.

Ferro-molybdenum.—65/70 per cent., carbon-free, 12s. 10d per lb. of Mo.

Ferro-titanium.—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £287 0s. 0d.

Ferro-tungsten.—80/85 per cent., 10s. 7d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 13s. 7d. per lb. of W.

Ferro-chrome (6-ton lots and over, lumpy).—4/6 per cent. C, £81 10s. 0d. to £84 10s. 0d., basis 60 per cent. Cr scale 27s. 0d. to 28s. 6d. per unit; over 6 per cent. C, £79 0s. 0d. to £82 10s. 0d., basis 60 per cent. Cr, scale, 27s. 0d. to 28s. 6d. per unit; 2 per cent. C,* 1s. 8d. to 1s. 11d. per lb. Cr; 1 per cent. C,* 1s. 8d. to 1s. 11½d. per lb. Cr; 0.15 per cent. C,* 1s. 9½d. to 2s. 0½d. per lb. Cr; 0.10 per cent. C,* 1s. 9½d. to 2s. 0½d. per lb. Cr; 0.06 per cent. C,* 1s. 11d. to 2s. 1d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 6s. 10d. per lb.

Metallic Manganese.—94/96 per cent., carbon-free, £275 0s. 0d.; 96/98 per cent., £285 0s. 0d.

Ferro-columbium.—65/67 per cent., Cb + Ta, 19s. 9d. per lb., Cb + Ta.

Ferro-manganese (Standard).—78 per cent., £61 10s. 0d

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft u.t., 100 tons & over, £31 15s. 6d.; tested, 0.08 to 0.33 per cent. C, 100 tons & over, £32 5s. 6d.; hard (0.41 to 0.60 per cent. C), 50 tons and over, £33 17s. 0d.; silico-manganese, 50 tons and over, £42 16s. 6d.; free-cutting, 50 tons and over, £35 4s. 6d. SIEMENS MARTIN ACID (50 tons and over): Up to 0.25 per cent. C, £40 11s. 0d.; silico-manganese, £43 4s. 0d.

Billets, Blooms, and Slabs for Forging and for Stamping (50 tons and over).—BASIC: Soft, up to 0.33 per cent. C, £37 0s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £38 2s. 6d.; acid, up to 0.25 per cent. C, £41 14s. 0d.

*Average 68-70 per cent.

FINISHED STEEL

Heavy Plates and Sections (50 tons and over).—Ship plate (N.-E. Coast), £40 7s. 0d.; boiler plates (N.-E. Coast), £42 17s. 0d.; floor plates (N.-E. Coast), £41 16s. 0d.; angles (N.-E. Coast), £38 1s. 6d.; joists (N.-E. Coast), £37 17s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., and flats 5 in. wide and under, untested soft basic, 50 tons and over, £39 1s. 0d.; under 10 tons to 4 tons, £40 18s. 6d.; under 4 tons to 2 tons, £41 3s. 6d.; hoop and strip, coils, 100 tons and over, £38 0s. 0d.; uncoated strip mill coils, hot rolled, under 3 mm. to 12g., 25 tons to under 50 tons, £43 16s. 0d.; black sheets (hand mill), 24g., 10 tons and over, £57 14s. 6d.; galvanized corrugated sheets, 24g., 10 tons and over, £67 11s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £66 7s. 0d.; nickel-chrome, £97 1s. 0d.; nickel-chrome-molybdenum, £109 14s. 0d., in lots of 25 tons and over.

NON-FERROUS METALS

Copper.—Cash, £227 15s. 0d. to £228 0s. 0d.; three months, £227 15s. 0d. to £228 0s. 0d.; settlement, £228 0s. 0d.

Copper, Tubes, etc.—Solid-drawn tubes, 2s. 1½d. per lb.; rods, 240s. 0d. per cwt. basis; 20 s.w.g., 275s. 0d. per cwt.

Tin.—Cash, £801 10s. 0d. to £802 0s. 0d.; three months, £803 10s. 0d. to £804 0s. 0d.; settlement, £802 0s. 0d.

Lead (Refined Pig).—Second half February, £66 10s. 0d. to £66 12s. 6d.; second half May, £67 5s. 0d. to £67 7s. 6d.; settlement, £66 12s. 6d.

Zinc.—Second half February, £84 15s. 0d. to £85 0s. 0d.; second half May, £83 12s. 6d. to £83 15s. 0d.; settlement £85 0s. 0d.

Zinc Sheets, etc.—Sheets, 15g., and thicker, all English destinations, £122 5s. 0d.; rolled zinc (boiler plates), all English destinations, £120 10s. 0d.; zinc oxide (Red Seal) d/d buyers' premises, £95 0s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 1s. 9½d. per lb.; sheets to 10 w.g., 197s. 0d. per cwt.; wire, 2s. 8½d.; rolled metal, 197s. 0d. per cwt.

Brass (Brazing).—BS1400, B3, £176; B6, £224.

Brass (High Tensile).—BS1400, HTB1, £196; HTB2 £213; HTB3, £231.

Gunmetal.—BS1400, LG2, £220; LG3, £230; G1, ½% £293; G1, 1%, £282.

Phosphor Bronze.—BS1400, PB1 (AID released), £310; BS1400, 90/10/1, £298.

Leaded Phosphor Bronze.—BS1400, LPB1, £242.

Phosphor Bronze Strip, etc.—Strip, 283s. 9d. per cwt.; wire, 4s. 0½d. per lb.; rods, 3s. 3½d.; tubes, 3s. 3½d.; chill cast bars, solids 3s. 3d.; cored 3s. 4d. (CHARLES CLIFFORD, LIMITED).

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 10½d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 3½d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 2½d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 2½d. to 2s. 3d. per lb.; Antimony, English, 99 per cent., £210 0s. 0d. Quicksilver, ex-warehouse, £69 0s. 0d. Nickel, £600 0s. 0d. Aluminium, ingots, £186 0s. 0d.; aluminium bronze (BS1400), 'AB1, £245; AB2, £253.

Company News

THOMAS ROBINSON & SON, LIMITED, woodworking and flour engineers, etc., of Rochdale (Lancs)—Final dividend of 12½ per cent. makes 15 (12½) per cent. for 1960. Net profit was £95,627 (£82,252), after tax of £92,999 (£57,971).

BRITISH OXYGEN COMPANY, LIMITED—It is proposed to make a one-for-two scrip issue to ordinary shareholders. The issue will be in non-renounceable form, "fractions being satisfied in cash," states the chairman, Mr. J. S. Hutchison.

INTERNATIONAL COMBUSTION (HOLDINGS), LIMITED—As foreshadowed when the interim dividend was paid, the final dividend of 20 per cent. maintains a total of 30 per cent. for the year ended September 30, 1960. Group profits declined to £871,277 (£1,453,659), after UK tax of £1,004,341 (£1,542,135).

HADFIELDS, LIMITED, steelmakers and engineers, of Sheffield—Final dividend of 3 per cent. makes 6 per cent. (same) for the year ended October 1, 1960. Group net profit was £217,676 (£302,575), after tax of £250,318 (£301,453). The directors state that although the profits arising from the sale of Hadfields' products showed an improvement over the previous year, the Millspaugh, Limited, group suffered a loss both at home and in Canada.

CRABTREE ELECTRICAL INDUSTRIES, LIMITED—Turnover is still increasing, but profit margins are tending to reduce with the increases in wages and the cost of materials. The final result for the year ending July 31, 1961, therefore, may not be materially better than last year, state the directors. The interim dividend is raised from the equivalent of 3¼ per cent. to 5 per cent. in order to bring it more in line with the 12½ per cent. equivalent total paid for 1959-60.

MONSANTO CHEMICALS, LIMITED—Unchanged second interim dividend of 10 per cent. maintains the total dividend at 15 per cent. for the year ended December 31, 1960. Group net profit was £1,700,342 (£1,693,266), after tax of £1,251,016 (£1,194,396). For the first time sales exceeded £20,000,000 with the historically high export portion, which, says the chairman, Sir Miles Thomas, was well maintained at 35 per cent. in extremely competitive and difficult conditions which faced the group.

AVELING-BARFORD, LIMITED—Output of the group in the year ended September 30, 1960, increased by 20 per cent. "and would have been higher had the additional materials and essential components been available," states Mr. Edward Barford, the chairman, adding that these conditions are now improving. The present order-book is "most satisfactory." It is proposed to raise the authorized share capital from £2,250,000 to £3,875,000 by the creation of 6,500,000 ordinary 5s. shares. The board has no immediate intention of issuing further capital.

GEORGE KENT, LIMITED—The proposed acquisition of 51 per cent. of the share capital of the Tieghi Company, of Milan and Lenno, has been effected. A new company has been formed Kent-Tjeghi S.p.A., which has purchased the whole of the assets and goodwill of the Tieghi Company. The Italian concern manufactures recorders and controllers for flow, pressure, and temperature of liquids and gases using pneumatic control systems. It also holds an exclusive import and distribution franchise for the American Conoflow range of pneumatically operated control valves.

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Advertisements (accompanied by a remittance) and replies to Box Numbers should be addressed to the Advertisement Manager, Foundry Trade Journal, John Adam House, 17/19, John Adam Street, Adelphi, London, W.C.2. If received by first post Monday advertisements can normally be accommodated in the following Thursday's issue.

SITUATIONS WANTED

SALES AGENT in London area offers services to foundries producing castings either in stainless steel and alloy or in grey iron. Remuneration by commission. Box SA608, FOUNDRY TRADE JOURNAL.

YOUNG MAN. 22 years. Five years' practical experience, estimating experience, requires post with chance of advancement. Box YM593, FOUNDRY TRADE JOURNAL.

GENERAL MANAGER, 44, with life-time experience in foundry trade, desires change. First-class knowledge of all modern production methods for C.I. including mechanised production of moulds and cores. Has ability to organise administration and technical staff and has an excellent customer relationship. Box GM582, FOUNDRY TRADE JOURNAL.

FOUNDRY EXECUTIVE, 35, B.Sc., experience of ferrous and non-ferrous trade, desires post with prospects. Production or representation considered. Foundry equipment, foundry suppliers, consultancy, etc. All enquiries answered. Box FE616, FOUNDRY TRADE JOURNAL.

TECHNICALLY trained FOUNDRYMAN, aged 50, well known at Directors' level, seeks post as Technical Liaison, Service Engineer, Representative. Box TT609, FOUNDRY TRADE JOURNAL.

MELTING SHOP FOREMAN (30), wide experience acid/basic E/A furnaces, all types high and low alloy steels, seeks similar position overseas, preferably India. Box MS615, FOUNDRY TRADE JOURNAL.

INDIAN FOUNDRYMAN, 36, M.I.B.F., returning India, seeks position with British concern, ferrous, non-ferrous, 15 years' experience. Box IF612, FOUNDRY TRADE JOURNAL.

WORKS FOUNDRY MANAGER, 41, desires change. Patternmaking/foundry apprenticeship, wide experience practical, technical, commercial, non-ferrous, grey iron. Jobbing, repetition. Three years outside technical sales, well known, good connections, able introduce new business. Midlands preferred. Box WF611, FOUNDRY TRADE JOURNAL.

TECHNICAL ENGINEER wishes to represent a Foundry for Grey Iron, Aluminium and Non-ferrous Metals Die-castings in Aluminium, Mazak Lead, and Tin Alloys, etc. First class connection with works in London and Home Counties. Part expenses and commission. Box TE613, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

OPPORTUNITY for keen ENGINEER to assist in the planning and installation of a new mechanised Foundry. Excellent prospects. Apply giving details of age, experience, qualifications and salary required to Box OF619, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*contd.*

TECHNICAL SALES REPRESENTATIVE required for Iron Foundry situated in South Durham. Applicants must have knowledge of Iron Founding and sales experience, hold current driving licence, age preferably under 35 years. Only those with the necessary qualifications need apply, with full details of experience, etc., and salary to Box TS585, FOUNDRY TRADE JOURNAL.

ASSISTANT TO FOUNDRY MANAGER

APPLICATIONS are invited from men between the ages of 30 and 45 for the position of Assistant to the Foundry Manager in a modern mechanised grey iron foundry in the West Riding. The foundry produces up to 120 tons of machinery castings per week, ranging in weight from a few ounces to 4 cwt. These are produced on a fully mechanised plant with ancillary floor and bench moulding sections.

Candidates must possess a thorough practical and technical knowledge and have experience in all phases of modern grey iron foundry practice. He must have drive, initiative, organizing and executive ability and be able to control labour.

The post, which carries full staff status with contributory pension scheme, is progressive and offers scope for promotion. Assistance with housing is possible for the successful candidate.

Applicants should state age and give in chronological order full details of training, experience and positions held, with an indication of salary level.

All applications will be treated in strict confidence and acknowledged.

Write Box AA592, Foundry Trade Journal.

SITUATIONS VACANT—*contd.*

PATTERN SHOP FOREMAN, 35/45, required by expanding jobbing ironfoundry in Nottinghamshire. Experience with pipework advantageous. Good wage with bonus to suitable applicant having drive and initiative. Full details in confidence to Box PS604, FOUNDRY TRADE JOURNAL.

EXPERIENCED ESTIMATOR and Rate Fixer required for Gravity Die and Shell Moulding Departments. Preferably with knowledge of Work Study. Apply giving details of age, experience and salary required to: PERSONNEL MANAGER, Kent Alloys Limited, Temple Manor Works, Strood, Rochester, Kent.

BENCH FOREMAN.—Applications are invited from men between the ages of 30 and 45 for the position of Section Foreman to take charge of the sand slinger, bench moulding and shell moulding sections of a large modern mechanised grey iron foundry in the West Riding.

The foundry produces up to 120 tons of machinery castings per week ranging in weight from a few ounces up to 4 cwt.

Candidates must possess a thorough practical knowledge and have experience in all phases of modern grey iron practice, particularly in the above sections. He must have drive, initiative and organising ability and be able to control labour.

Reply in confidence, giving details in chronological order of experience and positions held and indication of salary to Box MF610, FOUNDRY TRADE JOURNAL.

MSL *have been retained to advise on the appointment of*

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for a company specialising in the design and construction of industrial furnaces and associated equipment. The company has recently embarked on a policy of expansion with a view to increasing its range of products and requires Technical Sales Engineers to assist in this development.

Candidates should have had technical sales experience, preferably in combustion equipment as applied to the steel or light engineering industries. Consideration will also be given to those who have been engaged in development work in these fields. A degree or other qualification in mechanical engineering or fuel technology would be an advantage, but this is not essential as general experience is most important.

Preferred age 35 to 45. The starting salary will be by negotiation and will depend on experience and ability, but would be in the region of £1,700 plus a a non-contributory pension scheme. A car will be provided. Please send brief details in confidence quoting reference GT.3110 to M. B. Berks.

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In no circumstances will a candidate's identity be disclosed to our client unless he gives permission after a confidential interview at which he will be given full details of the appointment.

SITUATIONS VACANT—*contd.*

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AIR COMPRESSOR required. Alley and McLellan. Two-stage approximately 300 F.A.D. 100 lb. per sq. inch delivery pressure. DUDLEY FOUNDRY CO., LTD., Moor Lane, Brierley Hill, Staffs.

WANTED.—Small size Wheelabrator required, also quantity of Moulding Boxes, 14 in. × 8 in., 12 in., 14 in. and 16 in. square, 16 in. round. Box SS617, FOUNDRY TRADE JOURNAL.

WANTED.—One R.2. and One R.4. Core Blower. One W.T.B.1A Wheelabrator. Box WO618, FOUNDRY TRADE JOURNAL.

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PATENTS

THE proprietor of British Patent No. 738943, entitled "A Water Wall Tile Structure," offers same for licence or otherwise to ensure practical working in Great Britain. Inquiries to SINGER, STERN & CARLBERG, 140 So. Dearborn St., Chicago 3, Illinois, U.S.A.

THE Proprietors of Patent No. 682316 for "Process for Producing Cast Iron," desire to secure commercial exploitation by Licence or otherwise in the United Kingdom. Replies to HASELTINE LAKE & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.2.

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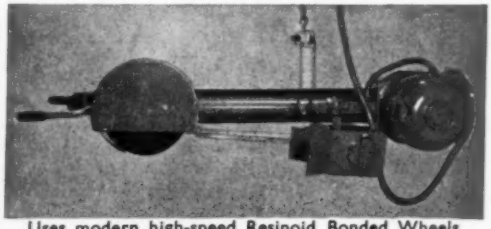

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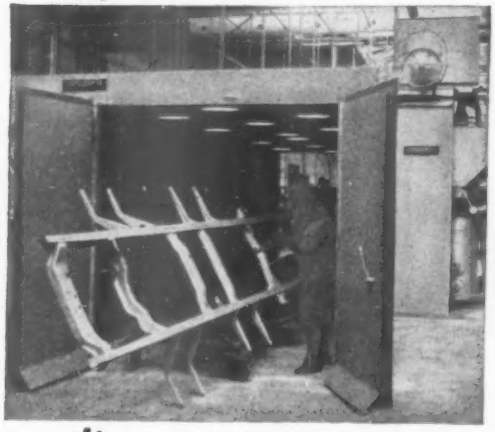

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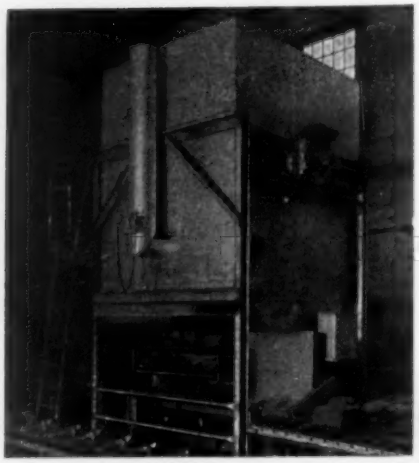

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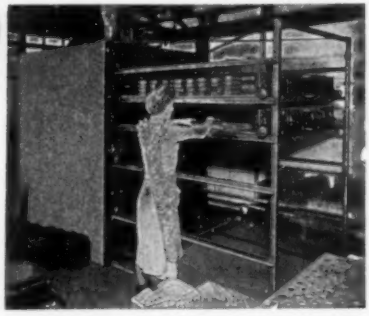

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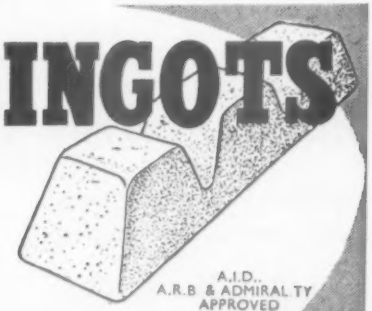

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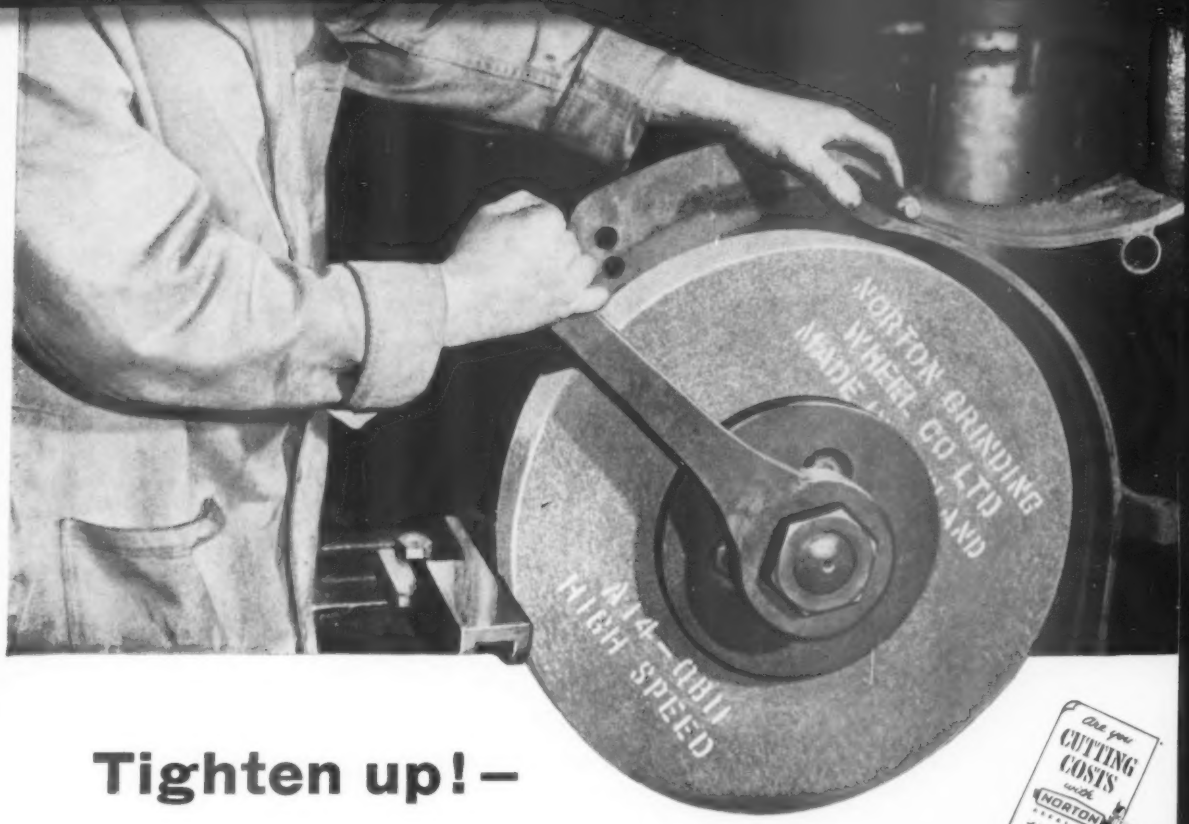

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EST. 1902

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VOL. 110
No. 2307

FEBRUARY 23, 1961

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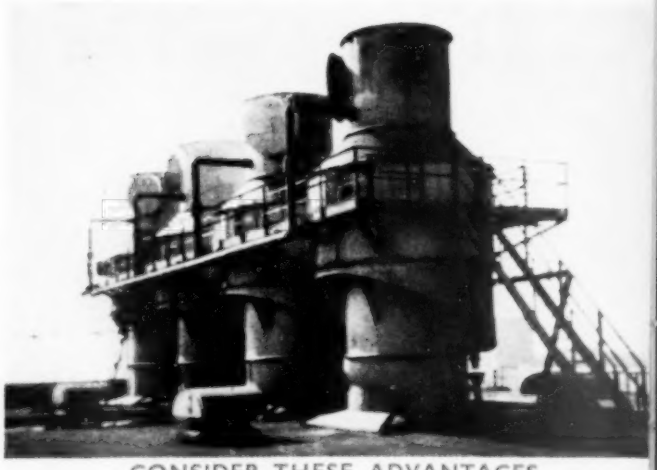
These are illustrated, the second Cupola from the left is "blowing"—note the complete absence of dark smoke, sure proof of efficiency.

Photo completely untouched taken during normal operating conditions.



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